DOCUMENT RESUME

ED 190 426 SO 012 736

AUTHOR Noyes, Joan
TITLE Basic Metrics--Part I, II and III. Teacher's Guide [and] Student Materials.
INSTITUTION Project Consumer Operations Survival Training (COST), Easton, Kans.
SPONS AGENCY Kansas State Dept. of Education, Topeka.
PUB DATE May 79
NOTE 208p.; For a listing of related documents, see SO 012 734.

EDRS PRICE MF01/PC09 Plus Postage.
DESCRIPTORS Class Activities; Consumer Education; Individualized Instruction; Learning Activities; Learning Centers (Classroom); *Metric System; Secondary Education; Social Studies; Teacher Developed Materials; Teaching Guides; Units of Study
IDENTIFIERS Project Consumer Operations Survival Training

ABSTRACT

Individualized classroom activities for use in learning centers to teach junior and senior high school students about the metric system are provided. The activities are organized into three sequential parts, each of which takes from four to six hours to complete. There is a teacher's guide and a student booklet for each part. The teachers' guides contain directions for organizing the learning centers and activities, copies of all student worksheets and pre- and posttests. The student booklets contain background readings and specific directions to guide the student from one activity to the next in the learning centers. In Part I, students identify the advantages of the metric system to the consumer, identify metric terms and symbols used in measuring length, and apply metric principles to solve problems in linear measure. Part II teaches students how to change prefixes and how to find area and volume/capacity. In Part III students learn how to measure mass and temperature in the metric system. Many different types of activities are provided. Students measure items in meters and centimeters, find the volume of containers using a liter measure and water, measure the weights of dry and wet sponges using metric scales and weights, prepare a comic strip showing how to measure in liters, make a bulletin board portraying the advantages of the metric system, and write an editorial which explains the advantages of the metric system and why it should be adopted. (Author/RM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
KSDE

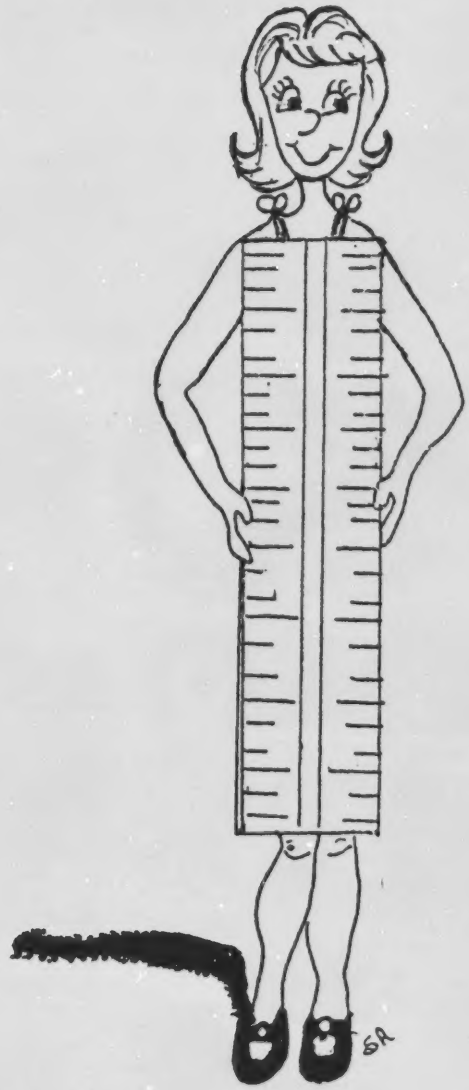
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ED190426

BASIC METRICS

PART 1

SP 012 736



Developed By:
Joan Noyes

As Part of
Project COST
ESEA Title IV
Kansas State Dept. of Education
USD 449
Easton, KS 66020

Illustrated by
Sherry Anderson

Teacher's Guide

TABLE OF CONTENTS

I. Package Resume Form 1

II. Objectives 2

III. Materials List 3

IV. Using Assessments 4

V. Notes to the Teacher 5

VI. Using Basic Metrics Capsules & the Center 6

VII. Management Station 7

VIII. Measuring Station 8-9

IX. Media Station 10-15

X. Keys 16-30

XI. Bibliography 31

XII. Appendix 32

XIII. Pre-Test 33-34

XIV. Post-Test 35-36

XV. Record Sheet 37

XVI. Worksheets 38-48

PACKAGE RESUME FORM

BASIC METRICS

PUBLICATION DATE: May, 1979

LEVEL/SUBJECT: Jr. - Sr. High

TITLE: Basic Metrics

AUTHOR: Joan Noyes

ABSTRACT:

Basic Metrics is a capsule on the basics of the metric system. The capsule investigates the advantages of the metric system, as well as, how to measure lengths in metrics. The activities include many actual measuring tasks. Prerequisite skills include: the ability to work problems using basic arithmetic operations and some ability to measure objects with a ruler or tape. Basic Metrics is a three part series which can be used in many content areas.

Basic Metrics--Part 2 continues with learning how to change the value of different prefixes, how to measure in area and volume/capacity in metrics. As in Part 1, the student will be doing many real measuring tasks. Before the student begins Part 2, he/she must successfully complete Part 1.

Basic Metrics --Part 3 continues with learning how to measure mass and temperatures in metrics and in tying all three capsules together.

Each capsule will take from 4-6 hours to complete. So,for all three capsules, the completion time is 12- 18 hours.

OBJECTIVES

When the student has completed this capsule, he/she should be able to:

* identity the advantages of the metric system to the consumer.

* identify metric terms and symbols used in measuring length.

* apply metric principles to solve problems in linear measure.

MATERIALS LIST

Teacher

mat board

wide transparent tape

poster board

construction paper

vinyl stick letters

yellow, blue, & green file folders

basket for finished papers

editorial from newspaper

1 wooden centimeter ruler

3 tables

discarded greeting card/
fabric swatches

index cards

Student

poster board

drawing paper

construction paper

graph paper

glue

felt-tip markers

copies of all worksheets

meter sticks

metric scales

scissors

metric measuring cups/spoons

centimeter rulers

8 new tubes of toothpaste

road map

USING ASSESSMENTS

Included in this capsule are a pre-test, a post-test, and a self-check. A copy of all assessments is found in the appendix.

Pre-Test

The student is directed by the capsule to take the Pre-Test at the appropriate time. A key is found in this guide. The Pre-Test should be used to indicate whether or not the student needs to complete this capsule.

Self-Check

The Self-Check at the end of Section Two will tell the student whether or not he/she is ready for the Post-Test. You will probably want to let students check their own work on this Self-Check. A key is found in this guide.

Post-Test

The Post-Test is designed to let you and the student know whether or not he/she has met the objectives of the capsule. A key is found in this guide.

NOTES TO THE TEACHER

SECTION ONE

This section of Basic Metrics--Part 1 deals with the advantages of using the metric system. The capsule introduces the student to the advantages. The activities are designed to reinforce the concepts just learned. Students will need to have access to art supplies in order to complete these activities.

SECTION TWO

Length is the topic for Section Two. In this section students will learn about meters, centimeters, millimeters, and kilometers. There are activities for each of these topics. Keys to these activities may be found in this guide.

ACTIVITY 4: DOT-TO-DOT FILE FOLDER

Remove the Dot-To-Dot picture and the directions from the appendix. Mount these inside a file folder. (Colored file folders make it more appealing.) Type the directions below on an index card and mount on the outside of the folder. Laminate (or cover with clear Contact paper) the folder. Students may use a china marker or felt-tip marker to do the dot-to-dot.

DOT-TO-DOT DIRECTIONS: Follow the directions inside to connect the dots and disclose a picture. Use your metric measure and draw straight lines with a marker. When you have finished, show your design to your teacher.

USING BASIC METRICS CAPSULES AND THE CENTER

This center is designed to be used with three learning capsules, Basic Metrics 1, 2, and 3. The capsules will serve the purpose of task cards, since they will direct the students to appropriate stations in the activities he/she has chosen. The capsules will also be a source of information to the student about metrics.

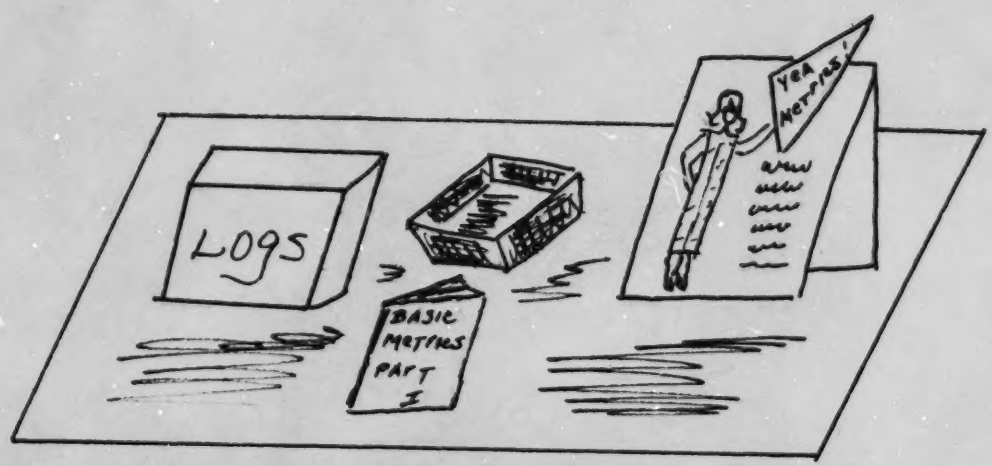
Students should be given a pre-test to determine which capsules in the sequence need to be done. All students will be required to complete Section One of Basic Metrics--Part 1. Since the time required for students to complete the first activity will vary, all students will not be at the same point in the capsule. Since space in some classrooms is limited, activities may take place at the students' desks. However, some activities will need to be completed at one of the satellite stations. You will want to limit the number of stations during a time period. Working time in the center will be 45 minutes per day for two or three weeks.

Students are directed by the capsule which they are using to complete activities. Directions are given in the capsule which tell them how to do the activity, where to go for materials and what to do with their work when they are finished.

The various stations of the center are spread out in the classroom to allow for flow of traffic and noise. A description of each station may be found on the following pages.

MANAGEMENT STATION

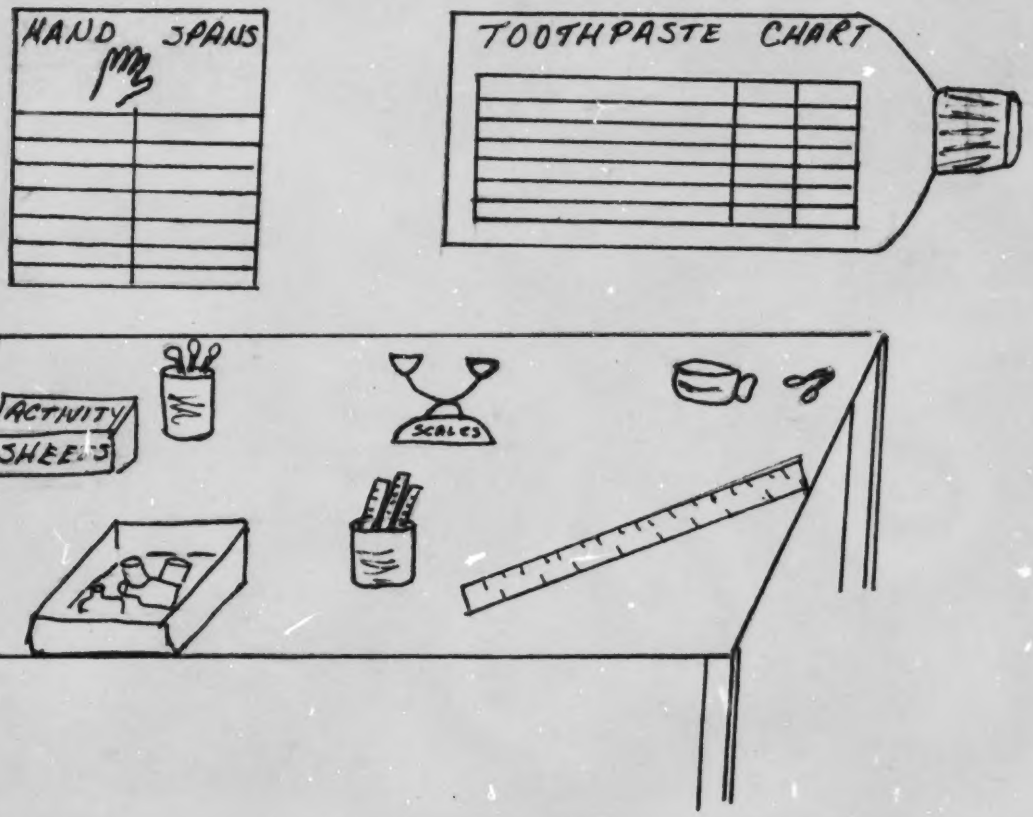
The Management Station consists of posters, a file for individual student logs, copies of the capsules Basic Metrics 1, 2, & 3, answer keys for activities, and a basket for completed work. A table top is used to display these items as shown below.



The Management Station

MEASURING STATION

The Measuring Station contains a box of assorted bottles, boxes, cans, popcorn, paper clips, etc. to be used for measurment activities. There is also a box for worksheets and games which go with the activities in this station. The station will contain rulers, scales, meter sticks, metric measuring cups and spoons for the various activities and the two charts described on the following page.

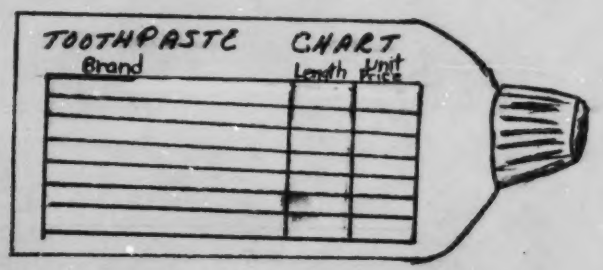


HAND SPAN CHART

This chart is used in Activity 6. Students will write their hand spans on the chart. In order to make the chart re-usable, it may be laminated first. Students may use a transparency marker or grease pencil to write on the chart.

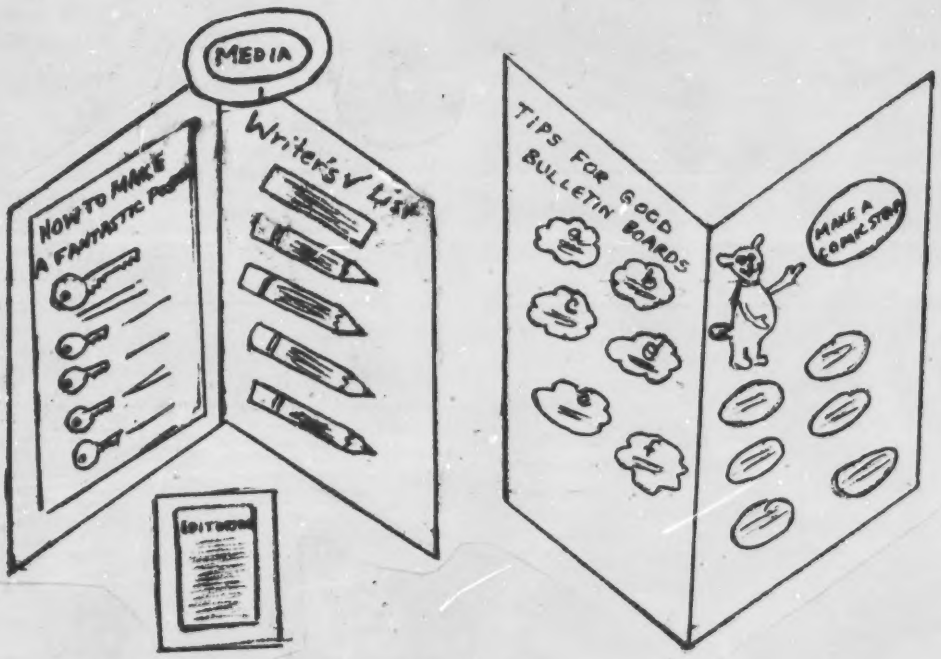
TOOTHPASTE CHART

This chart is used in Activity 7. Students will write the brand of toothpaste, the length of toothpaste and the unit price directly on the chart. As in Activity 6, you may wish to laminate the chart and have students use marking pens to make the chart re-usable.



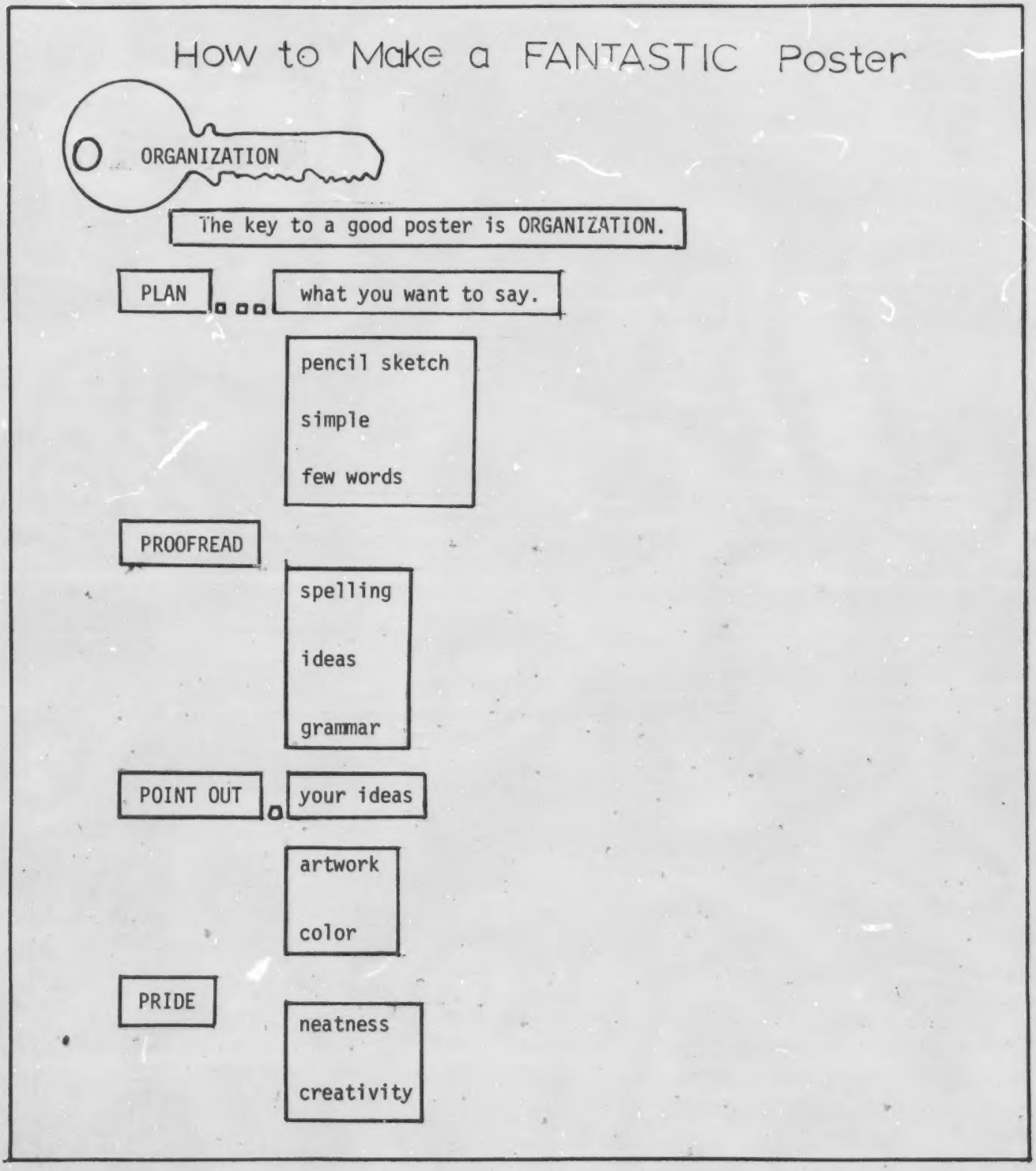
MEDIA STATION

This station is designed to be used as a teaching tool for students. It is constructed from mat board which has been hinged together with wide tape. Each section contains information needed by students to complete writing or display activities. Detailed descriptions of each section are given on the following pages.



How to Make a Fantastic Poster

This section of the Media Station is actually a poster which tells the student how to make a poster.



BEST COPY AVAILABLE

Writer's ✓ List

The Writer's ✓ List helps students proofread their work for errors. You may wish to have your students proofread their own work, or you may wish to use a buddy system for proofreading. Use construction paper and cut out the pencils. Mount the pencils and directions on the mat board. If the mat board and the pieces to be mounted are laminated first and put up with tape, the mat board may be reused for other centers.

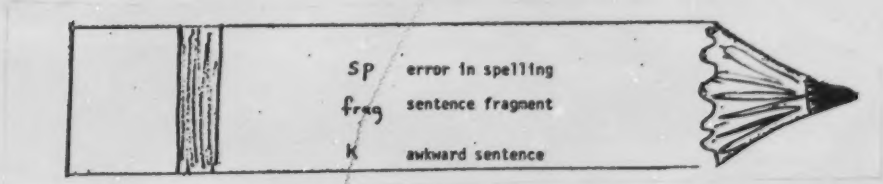
Have a classmate proof-read your paper for errors.

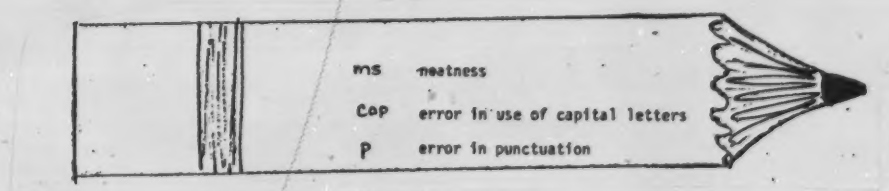
The proofreader will use the code below to mark each line in which there is an error.

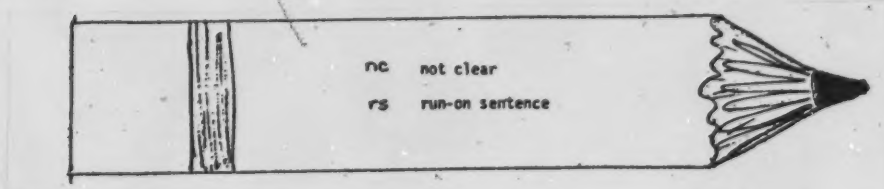
The proofreader will write the code letters in the left margin.

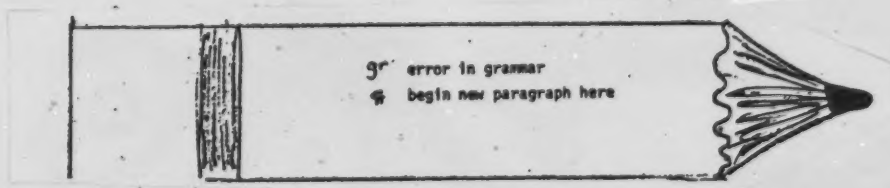
After the lines with errors have been marked, find each mistake and correct it.

Copy your writing over before handing it in or displaying it.









WRITING AN EDITORIAL

On a sheet of construction paper mount one or two editorials from your local newspaper. On the opposite side mount a copy of the paragraph below. This sheet may be laminated or placed in plastic to protect it from dirt.

Writing an Editorial

An editorial is a special type of newspaper article. It is the only type of article in a newspaper in which it is acceptable to express an opinion. Very often an editorial will attempt to persuade the reader about an issue. A sample editorial is found on the other side of this card. Study it carefully. Can you tell that this type of article is different from one that you might find on the front page of the newspaper?

TIPS FOR GOOD BULLETIN BOARDS

The following tips may be typed on index cards and mounted on swatches of fabric or the fronts of discarded greeting cards. Use a piece of burlap and plastic stick-on letters to make the title strip for this section of the Media Station.

Tips for Good Bulletin Boards
a Bulletin boards take planning.
b Decide the ideas you want to show with your bulletin board.
c Bulletin boards are better if they are simple and neat.
d Use color and artwork to help "sell" your idea.
e Letters should be large enough to be seen from a difference.
f Proofread your board for errors.

MAKE A COMIC STRIP

Make a larger copy of the title poster. This may be laminated to protect it. Type the information below onto index cards or small circles. The cards or circles may be mounted on contrasting paper to make them stand out.

1
Plan your story before you begin drawing your cartoon.

2
Use the cartooning sheet that your teacher has provided at this station.

3
Sketch your cartoon in the comic strip squares.

4
Proofread your comic strip. Use the Writer's ✓ List.

5
Use line-line felt tip pens or colored pencils to go over your sketches.

BASIC METRICS I

PRE-TEST

Name Key Date _____

Circle the numerals beside the statements that list advantages of the metric system.

(1.) There are fewer terms to learn in the metric system.

2. You do not have to know how to use decimals.

3. It is more economical.

(4.) All units are in base 10.

(5.) Less time is needed to convert from one unit to another.

(6.) It is used by many other countries.

Circle the letter of the answer that correctly finishes the statement.

7. The abbreviation cm stands for

(a.) centimeter

b. centritic

c. centigram

d. cubic centimeter

8. 1 m = _____ cm

a. 10

(b.) 100

c. 1000

d. .01

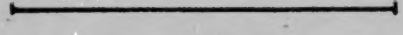
9. The abbreviation for millimeter is

   a. m
   b. ml
   (c.) mm
   d. mt

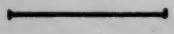
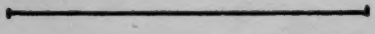
10. Which of the following is not used to measure length in the metric system?

   a. meter
   b. centimeter
   (c.) milliliter
   d. dekameter

Get a metric measure from the Measurement Station. Measure the length of the following lines in centimeters. Write the length in the space provided.
Accept answers that are correct ± 0.1 cm.

11. 7.1 cm
12. 2.0 cm
13. 0.9 cm
14.  5.5 cm

Use the metric measure to find the length of these line segments. Write the length in millimeters in the space provided.
Accept answers that are correct ± 1mm

15. 3 mm
16.  22 mm
17.  52 mm
18. 71 mm
19. 9 mm

20. A kilometer is 0.6 of a mile. If you travel 10 miles how many kilometers have you gone?

   a. 167 km
   b. 1.67 km
   (c.) 16.7 km
   d. 1670 km

WORKSHEET #1

Name Key Date _____

Complete this worksheet and turn it in when you are finished.

1. The abbreviation for meter is m.

Circle the correct answer.

2. To measure in metrics use a

   a. yard stick

   (b.) meter stick

Using a meter stick, measure the following items. answers will vary but:

3. teachers desk about 1.5 m.

4. length of room answers will vary

5. width of room answers will vary

6. length of chalk board answers will vary

7. width of doorway about 0.9 m

8. height of door about 1.9 m

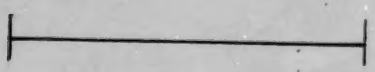
Activity 4
Section 2

WORKSHEET #2

Name Key Date _____

Complete this worksheet and turn it in when you are finished.

Using the supplies from the Measurement Station, make a drawing of a line 5 cm long and see how it compares to 5 inches. Explain briefly your findings.



EXPLAIN YOUR FINDINGS:

5 cm is less than half as long as 5 inches

WORKSHEET #3

Name Key Date _____

Complete this worksheet and turn it in when you are finished.

Get a metric measure from the Measurement Station and measure the following lines in centimeters. Record the lengths on this paper. Correct if ± 0.1 cm

	YOUR ANSWER
A. ———	1.8 cm
B. ———	2.4 cm
C. ——	0.9 cm
D. ——	1.1 cm
E. ———	2.6 cm
F. ———	3.4 cm
G. ———	5.2 cm
H. ———	7.8 cm
I. ———	2.1 cm
J. ———	3.9 cm

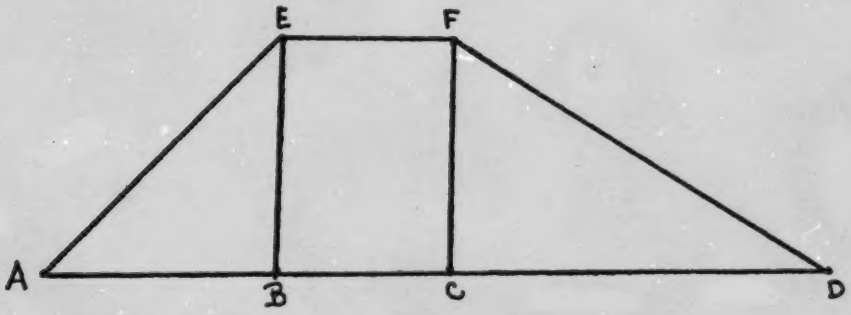
Activity 4
Section 2

WORKSHEET #4

Name Key Date _____

Complete this worksheet and turn it in when you are finished.

How long are the Line Segments?



Find the length of the given line segments by measuring with a metric ruler found in the Measurement Station, by measuring from first letter to second letter. Correct if ± .1 cm

1. $\overline{AB}$ = 3.3 cm
2. $\overline{CD}$ = 5.5 cm
3. $\overline{BE}$ = 3.4 cm
4. $\overline{CF}$ = 3.4 cm
5. $\overline{AC}$ = 5.8 cm
6. $\overline{BD}$ = 8.0 cm
7. $\overline{CD}$ - $\overline{EF}$ = 3.0 cm
8. $\overline{AB}$ + $\overline{CF}$ + $\overline{EF}$ + $\overline{AE}$ = 14.1 cm
9. $\overline{BD}$ + $\overline{CF}$ - $\overline{FD}$ = 4.9 cm
10. $\overline{AC}$ + $\overline{AE}$ + $\overline{CF}$ - $\overline{EF}$ = 12.5 cm

Activity 4
Section 2

WORKSHEET #5

Name Key Date _____

Complete this worksheet and turn it in when you are finished.

Since you know that 1 mm is about the size of a pin head, estimate the length of the following lines. After you have done that, go back and measure the exact length of each line and record the amounts on the line provided.

Correct if ± 1mm

ESTIMATED	ACTUAL	
_____ mm	24 mm	A. ———
_____ mm	10 mm	B. —
_____ mm	31 mm	C. ———
_____ mm	49 mm	D. ———
_____ mm	8 mm	E. —
_____ mm	42 mm	F. ———
_____ mm	70 mm	G. ———
_____ mm	5 mm	H. —

*Show your estimates to your teacher and then measure.

Activity 4
Section 2

WORKSHEET #6

Name Key Date _____

Complete this worksheet and turn it in when you are finished.

Get a metric measure from the Measurement Station and measure the following lines in millimeters. Record the lengths on this paper.
Correct if ± 1mm

		YOUR ANSWER
A.	———	17 mm
B.	———	22 mm
C.	——	9 mm
D.	——	11 mm
E.	———	27 mm
F.	———	35 mm
G.	———	52 mm
H.	———	77 mm
I.	———	22 mm
J.	———	41 mm

WORKSHEET #7

Name Key Date _____

Complete this worksheet and turn it in when you are finished. Be sure to show all of your work.

1. Change 11 miles to kilometers. Remember 1 km = 0.6 miles.

$$.6\overline{)11.0} = 18.2$$

18.2 km

2. Change 19 kilometers to miles.

$$19 \times .6 = 11.4$$

11.4 miles

3. Get a road map from the Measurement Station. Pick 2 cities and find the distance between the two. Change this distance from miles to kilometers. List the two cities and the distance between them, be sure to show all of your work.

Answers will vary.

DOT-TO-DOT DIRECTIONS

1. Start at Point A, find a point that is 1.3 cm away and draw a line from Point A to that dot.
2. From this point find a dot that is 0.5 cm away and draw a line to it.
3. From this point find a point that is 1.1 cm away and draw a line to that dot.
4. From this point draw a line to a point that is 2.3 cm away.
5. The next point is 5.3 cm away.
6. Then draw a line to the point 1 cm away.
7. The next point is 5.3 cm away.
8. 10.2 is the distance to the next point.
9. From this point draw a line to a point that is 1.2 cm away.
10. The next point is 1.7 cm away.
11. Then draw a line to the point 2 cm away.
12. The next point is 5.1 cm away.
13. 4.9 cm is the distance to the next point.
14. From this point draw a line to a point that is 1.2 cm away.
15. The next point is 1.6 cm away.
16. Then draw a line to the point 3.5 cm away.
17. The next point is 5.8 cm away.
18. 5.9 cm is the distance to the next point.
19. From this point draw a line to a point that is 3.5 cm away.
20. The next point is 1.5 cm away.
21. The next point is 1.4 cm away.
22. Then draw a line to the point 4.8 cm away.
23. The next point is also 4.8 cm away.
24. 2 cm is the distance to the next point.

Dot-To-Dot Directions (con't)

25. The next point is 1.9 cm away.
26. Then draw a line to the next point which is 1.2 cm away.
27. From this point draw a line 10.2 cm away.
28. The next point is 5.1 cm away.
29. 0.9 cm is the distance to the next point.
30. Then draw a line 5.1 cm to the next point.
31. From this point draw a line 2.3 cm away.
32. The next point is 1.1 cm away.
33. 0.5 cm is the distance to the next point.
34. Then draw a line to the next point which is 0.8 cm away.
35. From this point draw a line 0.5 cm away.
36. Then draw a line 0.5 cm to the next point.
37. The next point is 0.5 cm away.
38. 0.6 cm is the distance to the next point.
39. From this point draw a line 0.9 cm away.
40. The last distance is 1.1 cm to the last dot.

If you have drawn your lines correctly, your design looks like a (an)

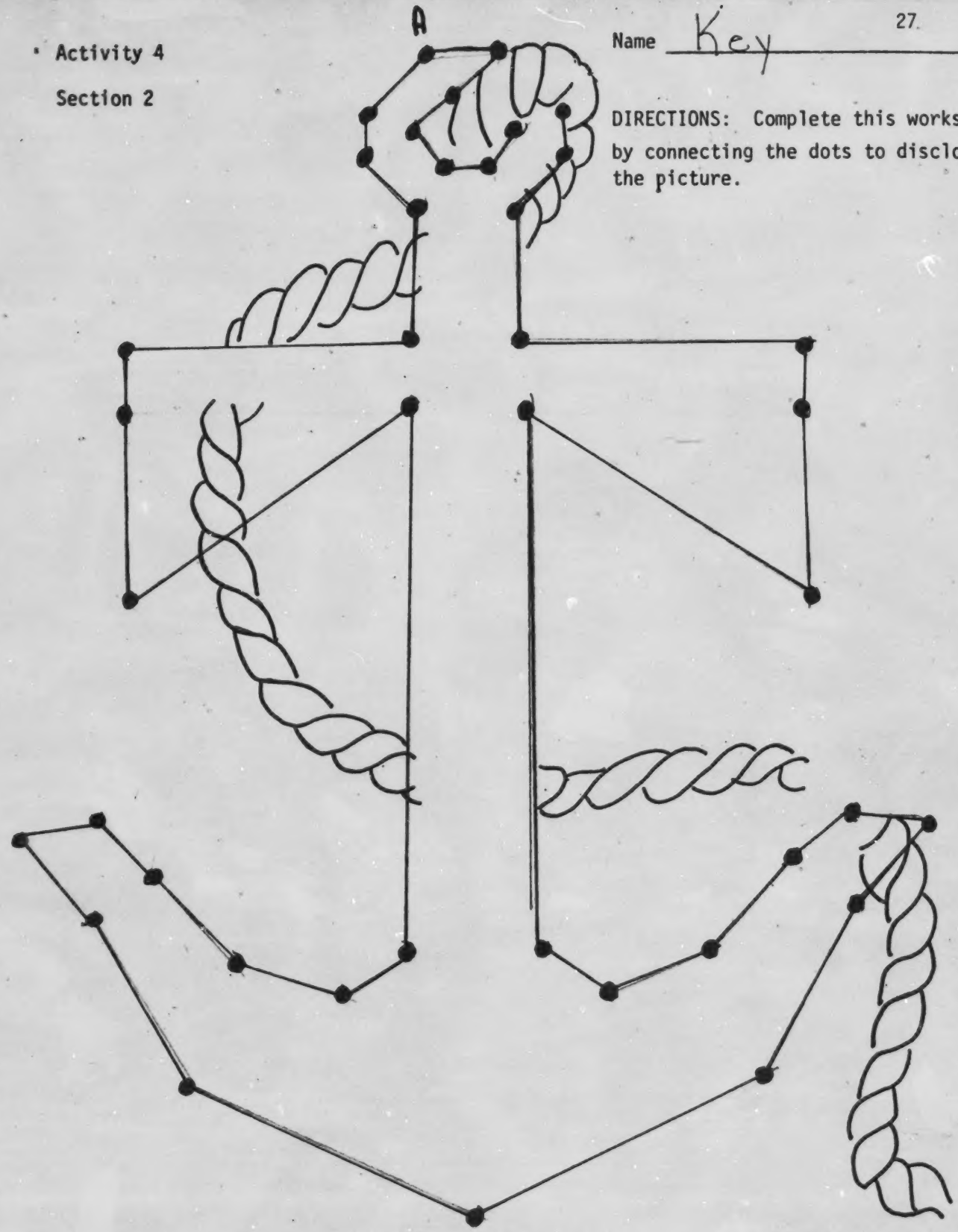
anchor ?

Activity 4

Section 2

Name Key

DIRECTIONS: Complete this worksheet by connecting the dots to disclose the picture.

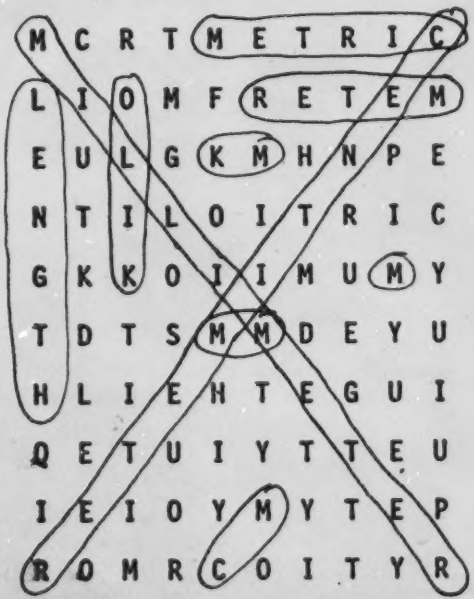


SELF-CHECK

Name Key Date _____

Complete the sentences and then find the word you used in the word search puzzle and circle it. When you finish, get the key and check your own paper and show it to your teacher.

1. How long something is, is called its length.
2. The unit of measure which is a little longer than a yard is a meter.
3. The unit of measure which is about the same size as your fingernail is called a centimeter.
4. The unit of measure which is about the size of a pin head is a millimeter.
5. The unit of measure used to measure long distances such as mileage is known as kilometer or kilo.
6. The abbreviation for millimeter is mm.
7. The abbreviation for meter is m.
8. The abbreviation for kilometer is km.
9. The abbreviation for centimeter is cm.
10. The name for this method of measuring is called metric.


M C R T M E T R I C
L I O M F R E T E M
E U L G K M H N P E
N T I L O I T R I C
G K K O I I M U M Y
T D T S M M D E Y U
H L I E H T E G U I
Q E T U I Y T T E U
I E I O Y M Y T E P
R O M R C O I T Y R

31

BASIC METRICS I

POST-TEST

Name Key Date _____

List 3 of the advantages of using the metric system.

1. takes less time to convert
2. packaging easier to compare
3. universal measurement
   not as many terms
   base 10

Circle the number of the metric units of measure that are correct when measuring length.

(4.) meter
(5.) centimeter
6. square meter
7. gram
(8.) millimeter
9. milliliter
10. inch

Give the abbreviations for the following terms on the line provided.

11. centimeter cm
12. millimeter mm
13. hectometer hm
14. decimeter dm
15. kilometer km
16. dekameter dam

Basic Metrics I Post-Test (con't)

Get a metric measure from the Measurement Station. Measure the length of the following line segments and record the length in centimeters.

17. 1.3 cm

18. 1 cm

19. 3.1 cm

20. 0.5 cm

Accept answers that are correct ± 0.1 cm

Use the metric measure to find the length of the following line segments. Record the length in millimeters.

21. 30 mm

22. 52 mm

23. 8 mm

24. 42 mm

Accept answers that are correct ± 1mm

25. You will remember that a kilometer is 0.6 mile. How many kilometers will you travel if you drive 15 miles?

15 ÷ 0.6 = 25 km

BIBLIOGRAPHY

Books

1. Bowles, Richard D.; Make Way for Metrication; Lerner Publication Co.; Minneapolis, Minnesota; 1975.

2. Kelly, Gerald W.; The Metric System Simplified; Sterling Publishing Co. Inc.; New York; 1976.

3. Ross, Frank Jr.; The Metric System; S. G. Phillips--Publisher; New York; 1974.

4. Young, Lorelle and Carole Bielefeld; Hometrics; Editor--Patricia M. Horton; Publisher--Enrich, Inc.; 1977.

Phamplets

1. "Going Metrics" John E. Roller, Director
Educational Service Center
Box 45308
Tulsa, OK 74145

2. "Metrics" Elinor Anderson and Mildred Walker
Cooperative Extension Service
Kansas State University
Manhattan, KS

3. "Teaching Metrication" Sears Roebuck and Co.
Consumer Information Services-D/703
Sears Tower
Chicago, IL 60684

Films

1. "A Metric America" Aims Films Media Services, Inc.
626 Justin Avenue
Glendale, California 91201

16 mm for jr.-sr. high Time- 16 minutes

Conversion, saving of time and effort, conversion of money, a share of international market place.

2. "Metric Measurement II" Journal Films
909 West Diversey Parkway
Chicago, IL 60614

16 mm for jr. high Time- 15 minutes
Measuring, comparison, and base 10.

APPENDIX

This appendix contains copies of all worksheets and assessments. These copies may be used to make your own classroom quantity copies. To use, unstaple the sides of the teacher's guide and remove the worksheet and assessment pages. Restaple the remaining pages of the teacher's guide.

BASIC METRICS I

PRE-TEST

Name _____ Date _____

Circle the numerals beside the statements that list advantages of the metric system.

1. There are fewer terms to learn in the metric system.
2. You do not have to know how to use decimals.
3. It is more economical.
4. All units are in base 10.
5. Less time is needed to convert from one unit to another.
6. It is used by many other countries.

Circle the letter of the answer that correctly finishes the statement.

7. The abbreviation cm stands for
   a. centimeter
   b. centritic
   c. centigram
   d. cubic centimeter

8. 1 m = _____ cm
   a. 10
   b. 100
   c. 1000
   d. .01

9. The abbreviation for millimeter is

   a. m

   b. ml

   c. mm

   d. mt

10. Which of the following is <u>not</u> used to measure length in the metric system?

   a. meter

   b. centimeter

   c. milliliter

   d. dekameter

Get a metric measure from the Measurement Station. Measure the length of the following lines in centimeters. Write the length in the space provided.

11. _____ cm

12. _____ cm

13. _____ cm

14. _____ cm

Use the metric measure to find the length of these line segments. Write the length in millimeters in the space provided.

15. _____ mm

16. _____ mm

17. _____ mm

18. _____ mm

19. _____ mm

20. A kilometer is 0.6 of a mile. If you travel 10 miles how many kilometers have you gone?

   a. 167 km

   b. 1.67 km

   c. 16.7 km

   d. 1670 km

BASIC METRICS I

POST-TEST

Name _____ Date _____

List 3 of the advantages of using the metric system.

1. _____
2. _____
3. _____

Circle the number of the metric units of measure that are correct when measuring length.

4. meter
5. centimeter
6. square meter
7. gram
8. millimeter
9. milliliter
10. inch

Give the abbreviations for the following terms on the line provided.

11. centimeter _____
12. millimeter _____
13. hectometer _____
14. decimeter _____
15. kilometer _____
16. dekameter _____

Basic Metrics I Post-Test (con't)

Get a metric measure from the Measurement Station. Measure the length of the following line segments and record the length in centimeters.

17. _____ cm

18. _____ cm

19. _____ cm

20. _____ cm

Use the metric measure to find the length of the following line segments. Record the length in millimeters.

21. _____ mm

22. _____ mm

23. _____ mm

24. _____ mm

25. You will remember that a kilometer is 0.6 mile. How many kilometers will you travel if you drive 15 miles?

_____

RECORD SHEET

Name _____ Sections to be Completed: 1 2 Both 1 & 2

ACTIVITIES	DATE COMPLETED	COMMENTS
Pre-Test	score:	
SECTION 1		
Choose one: Activity 1		
Activity 2		
Activity 3		
SECTION 2		
Activity 4 Choose three:		
Worksheet #1		
Worksheet #2		
Worksheet #3		
Worksheet #4		
Worksheet #5		
Worksheet #6		
Worksheet #7		
Dot-to-Dot		
Activity 5		
Activity 6		
Activity 7		
Self-Check		
Post-Test	score:	
Quest 1		
Quest 2		

Activity 4
Section 2

WORKSHEET #1

Name _____ Date _____

Complete this worksheet and turn it in when you are finished.

1. The abbreviation for meter is _____.

Circle the correct answer.

2. To measure in metrics use a
   a. yard stick
   b. meter stick

Using a meter stick, measure the following items.

3. teacher's desk _____
4. length of room _____
5. width of room _____
6. length of chalk board _____
7. width of doorway _____
8. height of door _____

Activity 4
Section 2

WORKSHEET #2

Name _____ Date _____

Complete this worksheet and turn it in when you are finished.

Using the supplies from the Measurement Station, make a drawing of a line 5 cm long and see how it compares to 5 inches. Explain briefly your findings.

EXPLAIN YOUR FINDINGS:

_____

_____

WORKSHEET #3

Name _____ Date _____

Complete this worksheet and turn it in when you are finished.

Get a metric measure from the Measurement Station and measure the following lines in centimeters. Record the lengths on this paper.

	YOUR ANSWER
A. ———	_____ cm
B. ———	_____ cm
C. ——	_____ cm
D. ——	_____ cm
E. ———	_____ cm
F. ———	_____ cm
G. ———	_____ cm
H. ———	_____ cm
I. ———	_____ cm
J. ———	_____ cm

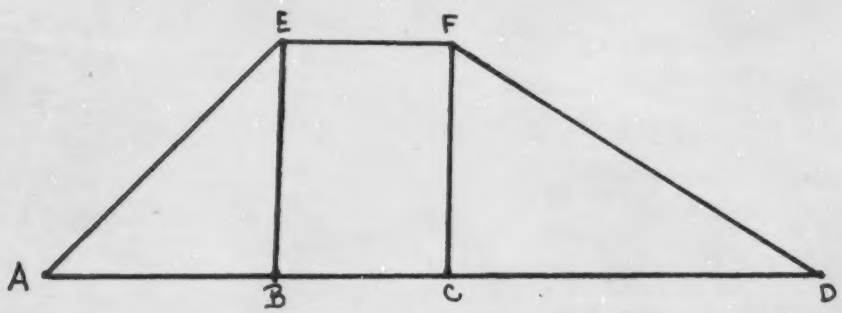
Activity 4
Section 2

WORKSHEET #4

Name _____ Date _____

Complete this worksheet and turn it in when you are finished.

How long are the Line Segments?



Find the length of the given line segments by measuring with a metric ruler found in the Measurement Station, by measuring from first letter to second letter.

1. $\overline{AB}$ = _____ cm
2. $\overline{CD}$ = _____ cm
3. $\overline{BE}$ = _____ cm
4. $\overline{CF}$ = _____ cm
5. $\overline{AC}$ = _____ cm
6. $\overline{BD}$ = _____ cm
7. $\overline{CD} - \overline{EF}$ = _____ cm
8. $\overline{AB} + \overline{CF} + \overline{EF} + \overline{AE}$ = _____ cm
9. $\overline{BD} + \overline{CF} - \overline{FD}$ = _____ cm
10. $\overline{AC} + \overline{AE} + \overline{CF} - \overline{EF}$ = _____ cm

Activity 4
Section 2

WORKSHEET #5

Name _____ Date _____

Complete this worksheet and turn it in when you are finished.

Since you know that 1 mm is about the size of a pin head, estimate the length of the following lines. After you have done that, go back and measure the exact length of each line and record the amounts on the line provided.

ESTIMATED	ACTUAL	
_____mm	_____mm	A. ———
_____mm	_____mm	B. —
_____mm	_____mm	C. ———
_____mm	_____mm	D. ———
_____mm	_____mm	E. —
_____mm	_____mm	F. ———
_____mm	_____mm	G. ———
_____mm	_____mm	H. —

*Show your estimates to your teacher and then measure.

Activity 4
Section 2

WORKSHEET #6

Name _____ Date _____

Complete this worksheet and turn it in when you are finished.

Get a metric measure from the Measurement Station and measure the following lines in millimeters. Record the lengths on this paper.

		YOUR ANSWER
A.	———	_____ mm
B.	———	_____ mm
C.	——	_____ mm
D.	——	_____ mm
E.	———	_____ mm
F.	———	_____ mm
G.	———	_____ mm
H.	———	_____ mm
I.	———	_____ mm
J.	———	_____ mm

Activity 4
Section 2

WORKSHEET #7

Name _____ Date _____

Complete this worksheet and turn it in when you are finished. Be sure to show all of your work.

1. Change 11 miles to kilometers. Remember 1 km = 0.6 miles.

2. Change 19 kilometers to miles.

3. Get a road map from the Measurement Station. Pick 2 cities and find the distance between the two. Change this distance from miles to kilometers. List the two cities and the distance between them, be sure to show all of your work.

Activity 4
Section 2

DOT-TO-DOT DIRECTIONS

1. Start at Point A, find a point that is 1.3 cm away and draw a line from Point A to that dot.
2. From this point find a dot that is 0.5 cm away and draw a line to it.
3. From this point find a point that is 1.1 cm away and draw a line to that dot.
4. From this point draw a line to a point that is 2.3 cm away.
5. The next point is 5.3 cm away.
6. Then draw a line to the point 1 cm away.
7. The next point is 5.3 cm away.
8. 10.2 is the distance to the next point.
9. From this point draw a line to a point that is 1.2 cm away.
10. The next point is 1.7 cm away.
11. Then draw a line to the point 2 cm away.
12. The next point is 5.1 cm away.
13. 4.9 cm is the distance to the next point.
14. From this point draw a line to a point that is 1.2 cm away.
15. The next point is 1.6 cm away.
16. Then draw a line to the point 3.5 cm away.
17. The next point is 5.8 cm away.
18. 5.9 cm is the distance to the next point.
19. From this point draw a line to a point that is 3.5 cm away.
20. The next point is 1.5 cm away.
21. The next point is 1.4 cm away.
22. Then draw a line to the point 4.8 cm away.
23. The next point is also 4.8 cm away.
24. 2 cm is the distance to the next point.

Dot-To-Dot Directions (con't)

25. The next point is 1.9 cm away.
26. Then draw a line to the next point which is 1.2 cm away.
27. From this point draw a line 10.2 cm away.
28. The next point is 5.1 cm away.
29. 0.9 cm is the distance to the next point.
30. Then draw a line 5.1 cm to the next point.
31. From this point draw a line 2.3 cm away.
32. The next point is 1.1 cm away.
33. 0.5 cm is the distance to the next point.
34. Then draw a line to the next point which is 0.8 cm away.
35. From this point draw a line 0.5 cm away.
36. Then draw a line 0.5 cm to the next point.
37. The next point is 0.5 cm away.
38. 0.6 cm is the distance to the next point.
39. From this point draw a line 0.9 cm away.
40. The last distance is 1.1 cm to the last dot.

If you have drawn your lines correctly, your design looks like a (an)

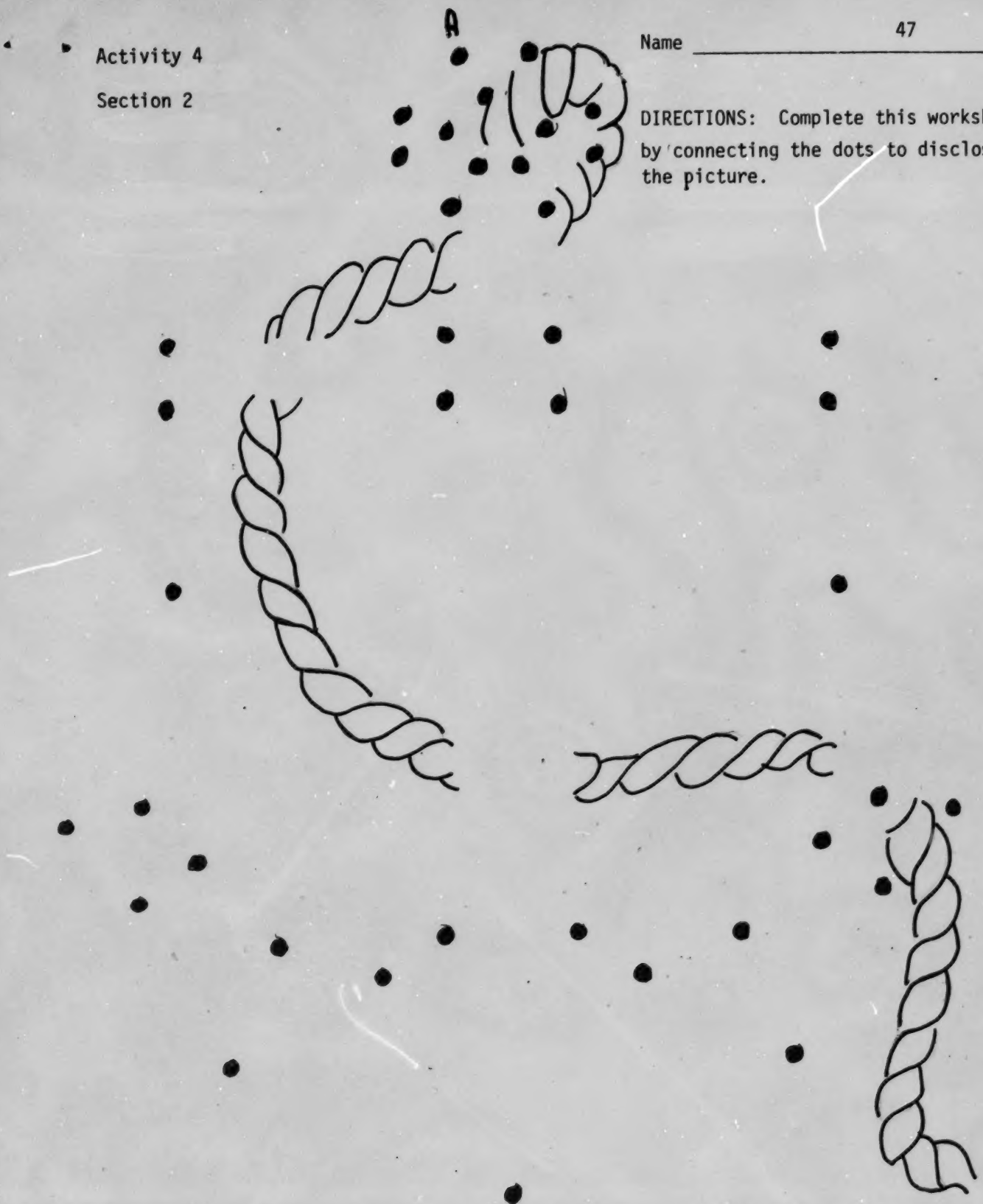
_____?

Activity 4

Section 2

Name _____ 47

DIRECTIONS: Complete this worksheet by connecting the dots to disclose the picture.



SELF-CHECK

Name _____ Date _____

Complete the sentences and then find the word you used in the word search puzzle and circle it. When you finish, get the key and check your own paper and show it to your teacher.

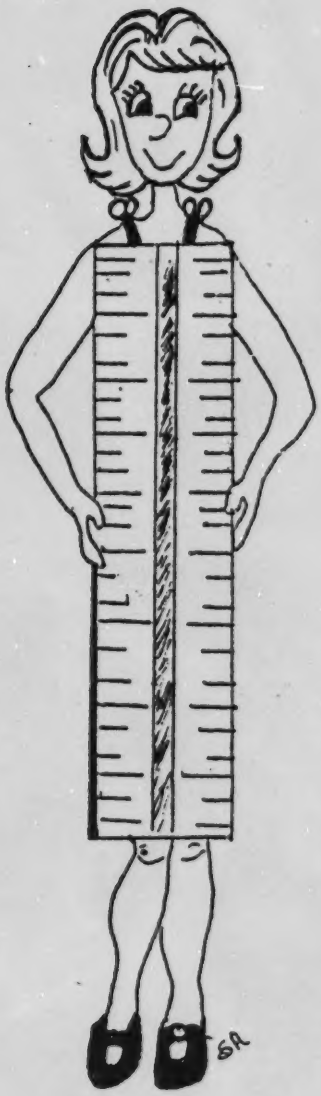
1. How long something is, is called its _____.
2. The unit of measure which is a little longer than a yard is a _____.
3. The unit of measure which is about the same size as your fingernail is called a _____.
4. The unit of measure which is about the size of a pin head is a _____.
5. The unit of measure used to measure long distances such as mileage is known as _____ or _____.
6. The abbreviation for millimeter is _____.
7. The abbreviation for meter is _____.
8. The abbreviation for kilometer is _____.
9. The abbreviation for centimeter is _____.
10. The name for this method of measuring is called _____.

M C R T M E T R I C
L I O M F R E T E M
E U L G K M H N P E
N T I L O I T R I C
G K K O I I M U M Y
T D T S M M D E Y U
H L I E H T E G U I
Q E T U I Y T T E U
I E I O Y M Y T E P
R O M R C O I T Y R

BASIC METRICS

PART 1

Student Materials



Developed By:
Joan Noyes

As Part of
Project COST
ESEA Title IV
Kansas State Dept. of Education
USD 449
Easton, KS 66020

Illustrated by

Sherry Anderson

FOR YOUR INFORMATION

This is a learning capsule. You will be using it to help you learn more about metrics. You will also be using a learning center to help you and your teacher organize the materials that you will need to complete the activities which are described in this capsule.

In this capsule are many different kinds of activities from which to choose. Some activities are required of all students, but others are optional. You will also have an opportunity in some parts of the capsule to choose which activities you wish to complete. In all cases you should read the information in the capsule carefully before attempting the activities.

CAPSULE OBJECTIVES

Upon completion of this capsule you will be able to:

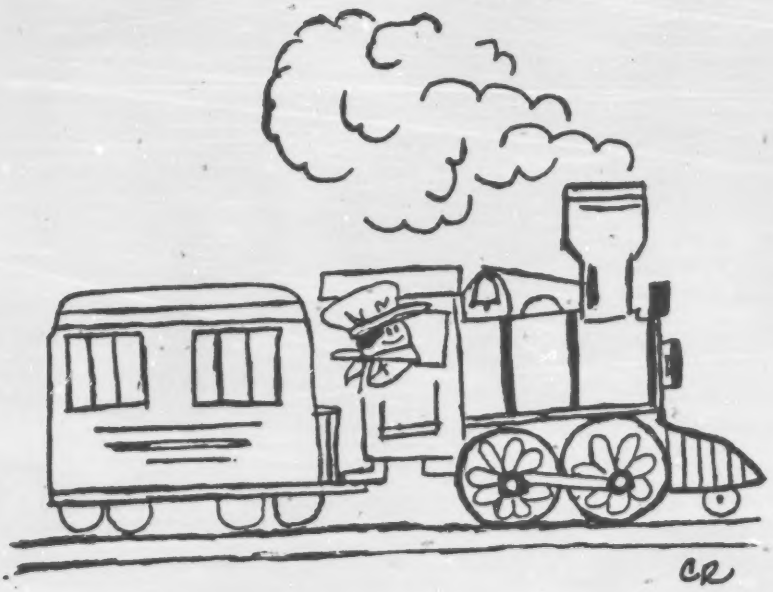
* 1. identify the advantages of the metric system to consumers.

* 2. identify metric terms and symbols used in measuring length.

* 3. apply metric principles to solve problems in linear measure.

PRE-TEST-----Part 1

Go to the Metric Center and get the Pre-test for Part 1 of Basic Metrics. Complete the test. Then turn it in for your teacher to check. That will tell you what sections of the capsule you need to do.



SECTION ONE

The Advantages of Metrics

Universal

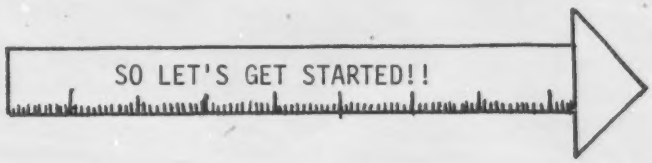
Ease in Comparing

Less Time Consuming

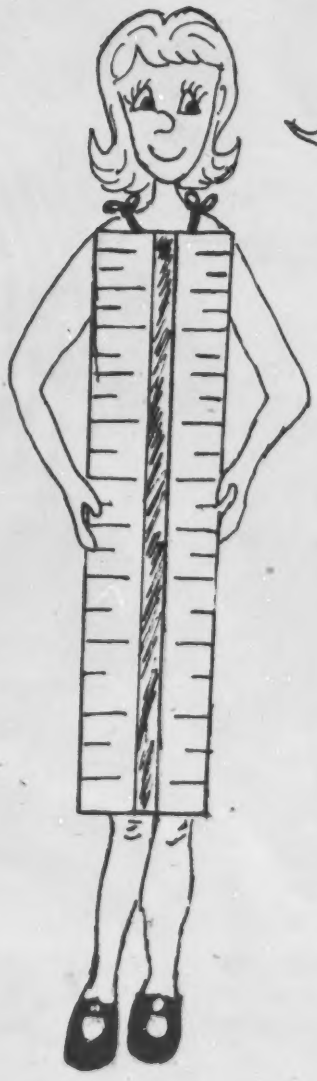
Ease to Use

The metric system seems complicated to many of us who already have become familiar with our conventional method of using inches, feet, yards, pounds, ounces, quarts, pints, miles, etc. But really, we have spent alot of time learning a more complicated system than if we had learned the metric system or SI (International System of Units).

In 1975 President Ford signed into law the "Metrics Conversion Act" which says that conversion will be voluntary, that there is no specific timetable for conversion, that a U.S. Metric Board will be set up to assist in planning and coordinating the changeover, and that the metric system will be followed. This law will affect all of us as consumers. In this section of the capsule, you will be learning some of the advantages of the metric system. For example, we will need to be able to use metric measurements in order to know how many meters of material will go into making a new dress or how many centimeters of wood are needed for your shop project. You will also be learning to make these kinds of measurements in this capsule.



This is Milli Meter. She is very well acquainted with the metric system, so she volunteered to help take you through this capsule.



Did you know that today, 90% of the world population uses the metric system?

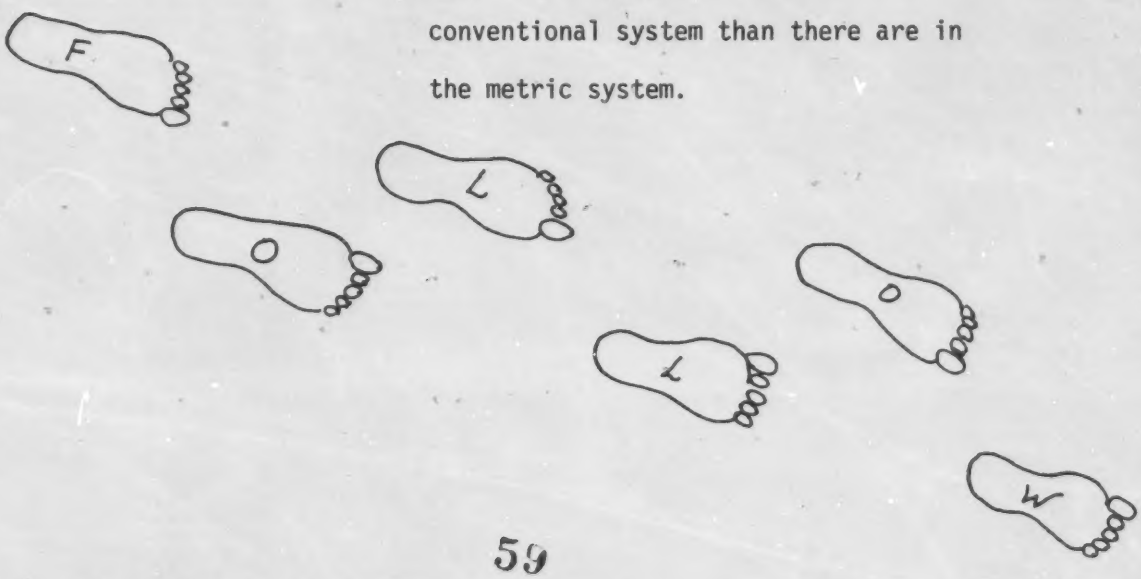
Did you know, however, that the United States is in the 10% that does not use the metric system consistently, along with Burma and four African countries?

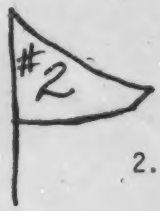
LET'S INVESTIGATE THESE FACTS A LITTLE MORE CLOSELY!!

There are several advantages of using the metric system over the conventional method of measurement. Some of them are:

1. <u>THERE AREN'T AS MANY TERMS TO LEARN</u>

The most common terms are meter, centimeter, millimeter, kilometer, gram, kilogram, milligram, liter, milliliter, celsius, and hectares. All of these terms are interrelated, where as the terms we use now such as inch, foot, yard, cup, pint, quart, gallon, bushel, peck, ton, pound, ounce, rod, etc. are obviously not related. There are more terms to learn in our conventional system than there are in the metric system.

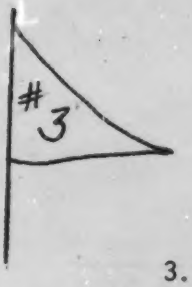




2. THE METRIC SYSTEM IS BASED ON 10's . . .

which makes it easier to figure. It uses whole numbers and decimals instead of fractions. You just move the decimal point over when changing prefixes. That makes the calculations a lot easier when you are trying to find out how much speaker wire to buy for your stereo.

DO USE	DO NOT USE
6.5	$6\frac{1}{2}$
.33	$\frac{1}{3}$
1.75	$1\frac{3}{4}$



3. THE METRIC SYSTEM IS A UNIVERSAL MEASUREMENT. . .

which makes trade with other countries easier and cheaper. If anyone in your family owns a car which was manufactured in another country, you have probably heard them talk about the problem of getting parts. Since the parts are made by metric measurements, they are not interchangeable with American-made parts which are not metric. This may mean you have to wait a long time on parts, and the parts may be more expensive since they must be shipped overseas. If all cars used metric standards, parts would be more readily interchangable. That could save the American consumer a lot of money!!

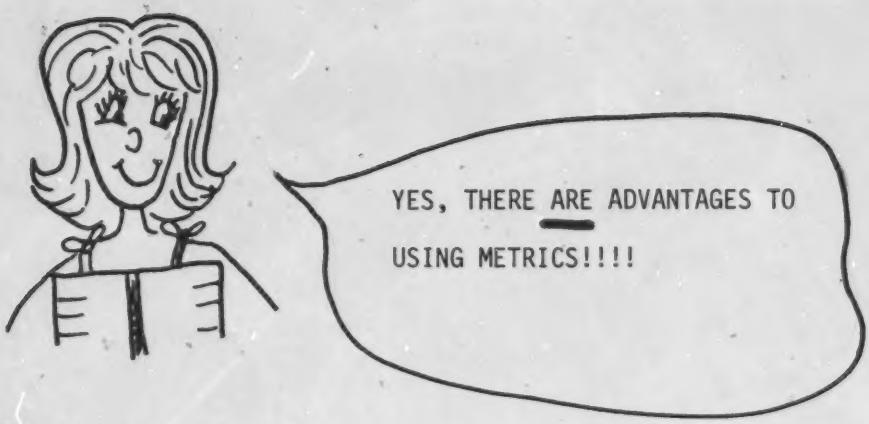
4. IT TAKES LESS TIME TO CONVERT...

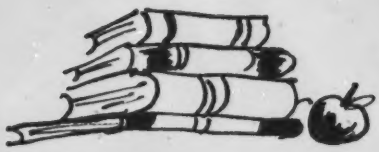
from metrics than from all of our customary measures since they are interrelated.

For example, 1 cm^3 = 1 ml

You could easily change from a volume of 1 cm^3 to liquid measurement of 1 ml.

You have read 4 advantages of using the metric system. Can YOU think of any more?





ACTIVITIES:

Do one of the following:

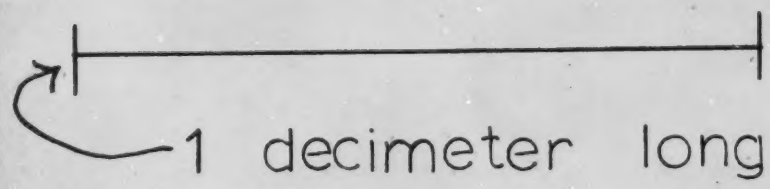
1. Choose one of the following media to portray the advantages of the metric system: make a poster, make a bulletin board, make a comic strip. Your project should show at least three of the advantages of the metric system. It may also show any other advantages that you can find or think of. You will find information about how to do these activities at the Media Station. You will also find the materials needed to complete the activities there. When you finish your project, display it in your class room.

2. Write a ½ to 1 page summary on the advantages of using metrics. Include at least three of the four advantages. Use the Writer's Check List at the Media Station to proof-read your work. When you have corrected your paper, give it to your teacher.

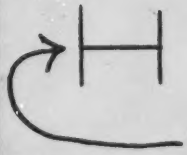
3. An editorial is a special type of newspaper article. It is the only type of article in a newspaper in which it is acceptable to express an opinion. A sample editorial is found at the Media Station. Study the editorial carefully. Then write an editorial which explains the advantages of the metric system and why you think it should be adopted. Use the Writer's Check List to proof-read your work. When you have corrected your paper, turn it in to your teacher. Perhaps it can be used in the school newspaper.

SECTION TWO

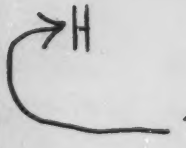
LENGTH



1 decimeter long



1 centimeter long



1 millimeter long

Section Two

In this section you will be learning the metric terms and symbols that have to do with measuring length.

LENGTH

length: meter = m

When measuring lengths in the metric system you use the unit "meter". The abbreviation for meter is m. In metrics the abbreviations do not have a period behind them unless they are at the end of a sentence. A meter is used for measuring such things as fabric, the length of a room, the distance a runner must go in a race, etc.

A meter is approximately 40 inches long and is a little longer than the conventional 36 inch yard stick. A meter is 3.3 feet, as compared to the 3 foot long yard.

To measure something in meters we use a meter stick, which looks like a yard stick that has been stretched.

CENTIMETER

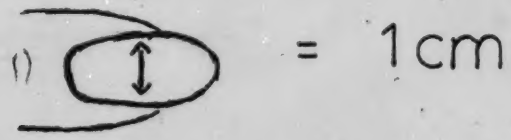
length: meter = m

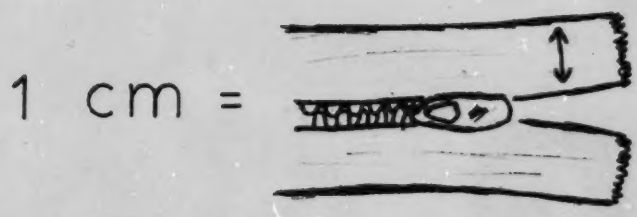
centimeter = cm

As we said earlier, the metric system uses 10 as its base, and that we can divide each of the units by 10 and get a different unit of measure. When we divide a meter by 100 we get a centimeter. The abbreviation for a centimeter is cm. 100 cm = 1 m therefore, 1 m = 100 cm.

cm scale

One centimeter is about the width of a fingernail or a zipper tape.





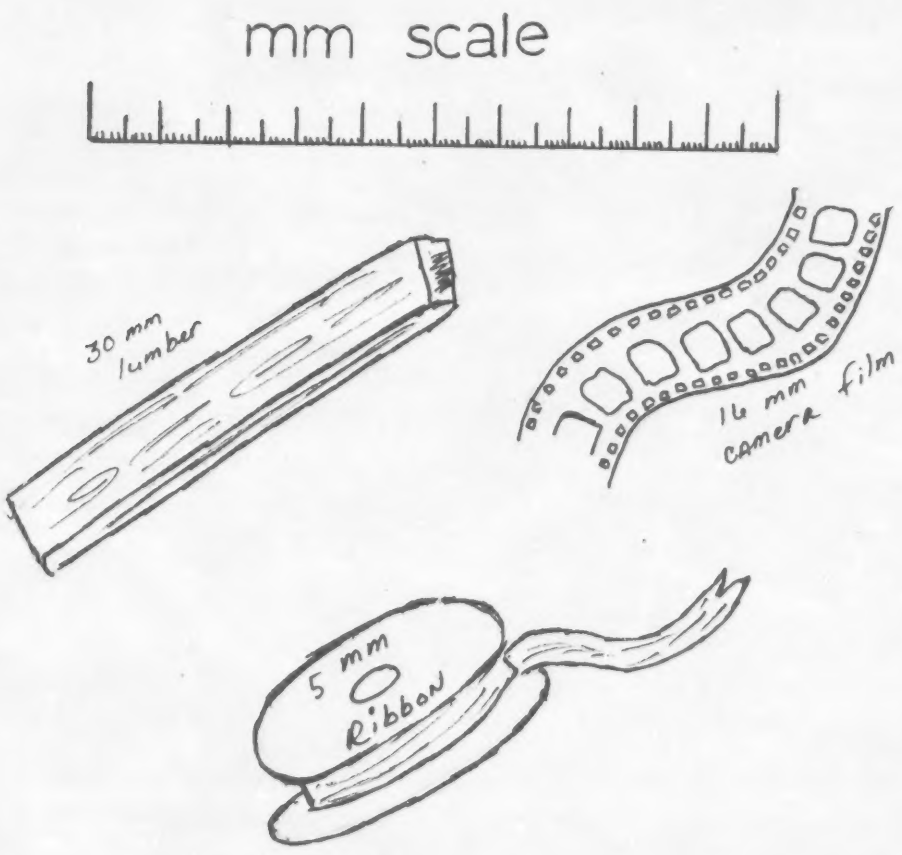
Some items that are measured in centimeters are: body measurements, appliance sizes, furniture sizes, etc. If your body measurements in inches are 36-24-36, in metrics it would be close to 92 cm—62 cm—92 cm. What are your body measurements in metrics? You will find a metric tape in the Measurement Center for you to use to find your measurements in centimeters.

MILLIMETER

length : meter = m
centimeter = cm
millimeter = mm

When you divide a centimeter into 10 parts it becomes a millimeter. The abbreviation for a millimeter is mm.
1 m = 100 cm and 1 cm = 10 mm so 100 x 10 = 1000 mm. 1 m = 1000 mm.
Here is a drawing of 1 centimeter. Notice that the centimeter is divided into 10 millimeters. As you can see, a millimeter is not a very large amount. It is used for measuring small lengths.

For comparison, a millimeter is about the width of a pin head. Some items that are measured in millimeters are camera film such as 35 mm. Film projectors use film that is 8 mm or 16 mm. Some lumber sizes and ribbon widths are measured in millimeters also. If you are working on a foreign car, the wrenches you need are in metric sizes.



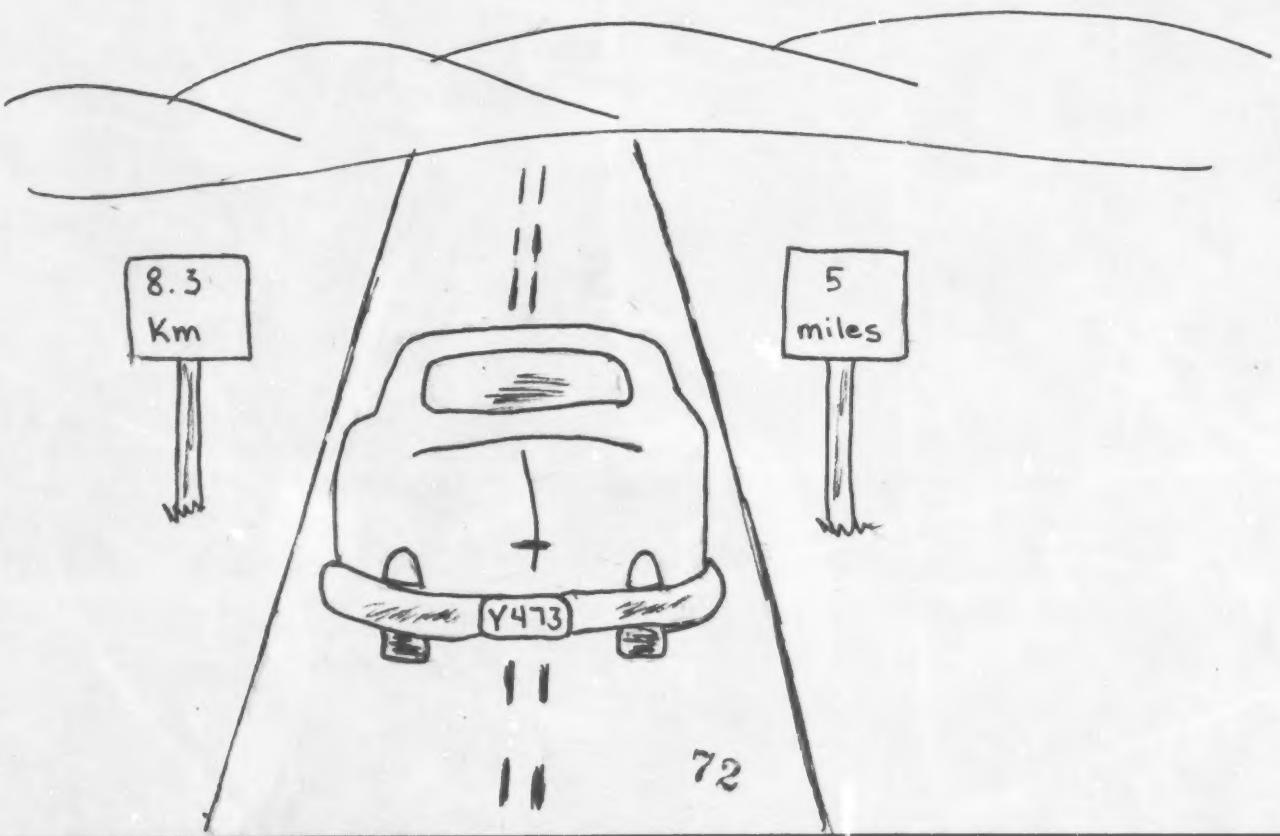
KILOMETER

length: meter = m
centimeter = cm
millimeter = mm
kilometer = km

We have looked at smaller units than a meter so let's go to the other end of the scale and look at a unit used to measure long distances. This is called a kilometer. The abbreviation is km. 1 km = 1000 m.

You would use kilometers to measure such distances as from one city to another or to measure something that is more than 1000 meters. The unit kilometer is used much like we use the unit of measure known as the mile.

If you were estimating, you would find that a kilometer is just a little more than ½ mile. 1 km = 0.6 mile. Let's do an example of how to compare miles to kilometers. If you drove 3 kilometers, how many miles would that be? Take 0.6 times 3 kilometers and it comes out 1.8 miles. You can also do the reverse. If you drove 5 miles, how many kilometers would that be? Divide 5 miles by 0.6 mile to find the answer. The answer would be 8.3 kilometers.



ACTIVITIES

4. Directions to the student: Complete 3 of these activities.

Worksheet #1

Worksheet #2

Worksheet #3

Worksheet #4

Worksheet #5

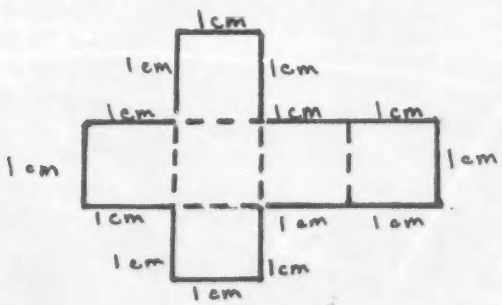
Worksheet #6

Worksheet #7

Dot-to-Dot File Folder Activity

5. Directions to the student: Complete each of these activities.

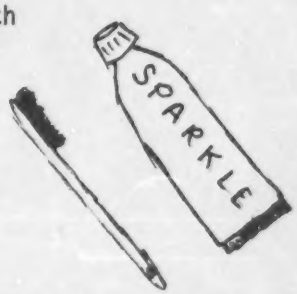
Go to the Measuring Station and get the following equipment: graph paper, metric ruler, scissors, and tape. You are going to make a cubic centimeter box. To do this draw solid lines 1 cm long as shown in the diagram. (see below) Cut out your diagram on the solid lines and fold on the dotted lines, so that you have a box. Tape the edges together. Show this box to your teacher when you are finished.



Turn the page to find the next activity that you must complete. . .

ACTIVITIES (con't)

6. Lay the palm of your hand down on a sheet of paper. Spread your fingers out as far as they will go. With a pencil, put a mark where your little finger is. Take a centimeter measure and measure the distance from the tip of your thumb to the end of your little finger and record your hand spread in centimeters. Write your name and your hand spread on the chart at the Measurement Station. How does your hand spread compare with that of your classmates?



7. Working with 2 or 3 other students complete this activity: Take one of the boxes of toothpaste from the Measurement Station. Squeeze the toothpaste out in a line. Measure the length of the toothpaste in your tube in centimeters. Write the length of the toothpaste in your tube in centimeters. Write the length on the Toothpaste Chart at the Measurement Station. Write the name of the brand of toothpaste beside the length. Calculate the cost of brushing your teeth. Divide the total number of centimeters in the tube by 2. This tells you how many times you can brush your teeth from this tube. Take that answer and divide it into the price of the toothpaste. Record the cost per brushing on the Toothpaste Chart at the Measurement Station. When every group of students has done this activity, see which toothpaste is the cheapest to use. Then show your teacher the calculations that you have made.

You have read about the most common prefixes that are used with meter but there are 3 others that are sometimes used. One is smaller than a meter and the other two are larger than a meter. Let's look at these for just a minute.

Remember that if you divided a meter by 1000, you would then have millimeters.

If you divided a meter by 100, you would then have centimeters.

If you divide a meter by 10 you would have decimeters.

1 meter (m) ÷ 1000 = 1000 millimeters (mm)

1 meter (m) ÷ 100 = 100 centimeters (cm)

1 meter (m) ÷ 10 = 10 decimeters (dm)

NOW... LET'S GO THROUGH THAT AGAIN!!!

When you multiply a meter by 10 you have a dekameter (dam).

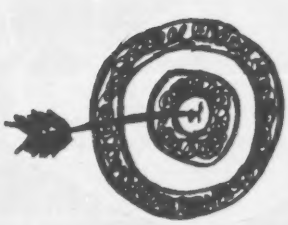
When you multiply a meter by 100 you have a hectometer (hm).

When you multiply a meter by 1000 you have a kilometer (km).

1 meter (m) x 10 = 1 dekameter (dam)

1 meter (m) x 100 = 1 hectometer (hm)

1 meter (m) x 1000 = 1 kilometer (km)



GOT THAT ?

RIGHT ON TARGET!!!

Go to the Metric Center and get the Self-Check--Length. Complete the self-check then get the answer sheet from the teacher and check your paper. When you are finished, turn in your paper to your teacher.

TIME FOR

A

SELF - CHECK

POST-TEST

When you feel you are ready, ask your teacher for the Post-Test. After you have finished, give the test back to your teacher to grade.

*** QUEST ***

1. Set up a metric football field or basketball court. Change the rules so they read correctly in metrics. Get together a team and play the game using the metric field and rules. Turn in a drawing of a scale model of the field you plan to make and a copy of the rules to your teacher.

2. Prepare and play the Meter Line Game

Give each player 10 strips of paper 1 decimeter in length. Prepare a deck of 45 size 3 x 5" cards with lines of the following lengths:

15 cards.....1 decimeter

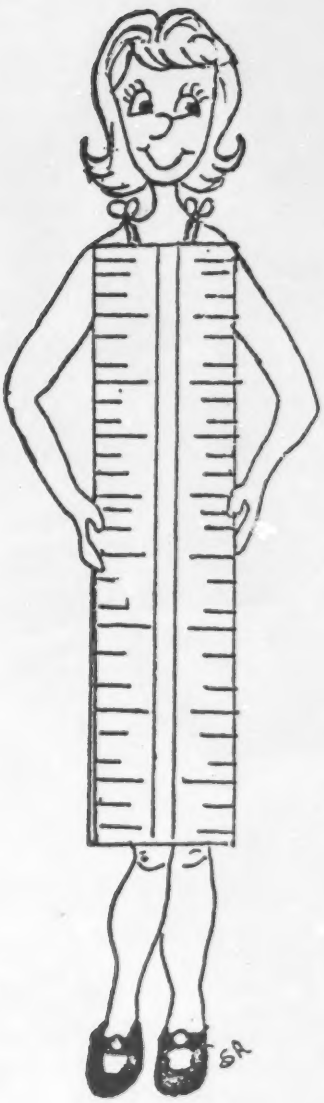
15 cards.....5 centimeters

15 cards.....2 centimeters

Shuffle deck and place face down. Make a meter line for each person with masking tape. Indicate decimeter lines but do not number them. Each person picks a card from the deck. They compare lines, the one who has the longest line gets to put a decimeter strip on his/her line. If two are the same length, neither player puts a strip down. Return cards to bottom of deck and draw again. The winner is the first person to cover his/her meter line with strips.

BASIC METRICS

PART 2



Developed By:
Joan Noyes

As Part of
Project COST
ESEA Title IV
Kansas State Dept. of Education
USD 449
Easton, KS 66020

Teacher's Guide

 Illustrated by Sherry Anderson

TABLE OF CONTENTS

Package Resume ---------- 1
Objectives ---------- 2
Materials List ---------- 3
Notes to Teacher ---------- 4
Using Basic Metrics Capsules and the Center ---------- 6
Management Station ---------- 7
Measuring Station ---------- 8
Media Station ---------- 9
How to Make a Fantastic Poster ---------- 10
Writer's √ List ---------- 11
Tips for Good Bulletin Boards ---------- 12
Make a Comic Strip ---------- 13
Using Assessments ---------- 14
Keys to Activities
- Pre-test ---------- 15
- Worksheet #2-7 ---------- 17
- Self Check: Section One ---------- 18
- Worksheet #2-8 ---------- 19
- Self Check: Section Two ---------- 20
- Self Check: Section Three ---------- 21
- Post-test ---------- 23

Bibliography ---------- 25
Appendix
- Record Sheet ---------- 27
- Pre-test ---------- 28
- Worksheet #2-7 ---------- 30
- Self Check: Section One ---------- 31
- Worksheet #2-8 ---------- 32
- Self Check: Section Two ---------- 33
- Self Check: Section Three ---------- 34
- Post-test ---------- 36
- Centimeter Grid ---------- 38

PACKAGE RESUME FORM

BASIC METRICS

PUBLICATION DATE: May, 1979

LEVEL/SUBJECT: Jr. - Sr. High

TITLE: Basic Metrics

AUTHOR: Joan Noyes

ABSTRACT:

Basic Metrics is a capsule on the basics of the metric system. The capsule investigates the advantages of the metric system, as well as, how to measure lengths in metrics. The activities include many actual measuring tasks. Prerequisite skills include: the ability to work problems using basic arithmetic operations and some ability to measure objects with a ruler or tape. Basic Metrics is a three part series which can be used in many content areas.

Basic Metrics--Part 2 continues with learning how to change the value of different prefixes, how to measure in area and volume/capacity in metrics. As in Part 1, the student will be doing many real measuring tasks. Before the student begins Part 2, he/she must successfully complete Part 1.

Basic Metrics --Part 3 continues with learning how to measure mass and temperatures in metrics and in tying all three capsules together.

Each capsule will take from 4-6 hours to complete. So, for all three capsules, the completion time is 12- 18 hours.

OBJECTIVES

Upon completion of this capsule the student will be able to:

identify metric terms and symbols that are used in measuring area and volume.

apply metric principles to solve problems in measuring area and volume.

MATERIALS LIST

Teacher

mat board
wide transparent tape
poster paper
construction paper
vinyl stick letters
yellow, blue and green file folders
basket for finished papers
editorial from newspaper
wooden centimeter ruler
index cards
discarded greeting cards/ fabric swatches

Student

centimeter grid paper (see appendix)
pencils
paper
½ gallon milk carton
several large and small containers
metric measuring cup
wooden/ plastic centimeter blocks
drawing paper
felt tip markers/crayons
milliliter measures
magazines
scissors
glue

NOTES TO THE TEACHER

Section One--Changing Values of Prefixes

Changing values of units is hard for some students, and you may need to use an alternate method of teaching it. Here is another that you might like to try. This can be done either at the board or on paper at the student's desk. Have the student make a large decimal point on his/her paper. On another piece of paper make the numerals of the problems as in the example below. Cut notches out between the numerals and the student can move the numerals either right or left with the decimal in the "v" of the cut out notch.

etc.

Changing values of prefixes is an important part of metrics to learn. You may need to include additional practice for your students who have difficulty with this skill.

Section Two--Area

In this section the student will be learning to calculate area in metrics. There are several different activities to help the student do this. The activities stress situations in which consumers need to know how to find area.

Section Three--Volume/Capacity

This section has several activities to help students learn how to measure volume. They are also asked to calculate the volume of cubes and rectangular prisms (vocabulary not used in capsule).

Students will need to be accurate in their measuring and also to use the correct measuring tools. In the Measuring Station you will need several different sizes of containers for your students to use in finding volume. You will need to have measured these yourself in order to check the accuracy of your students' measurements.

USING BASIC METRICS CAPSULES AND THE CENTER

This center is designed to be used with three learning capsules, Basic Metrics 1, 2, and 3. The capsules will serve the purpose of task cards, since they will direct the students to appropriate stations in the activities he/she has chosen. The capsules will also be a source of information to the student about metrics.

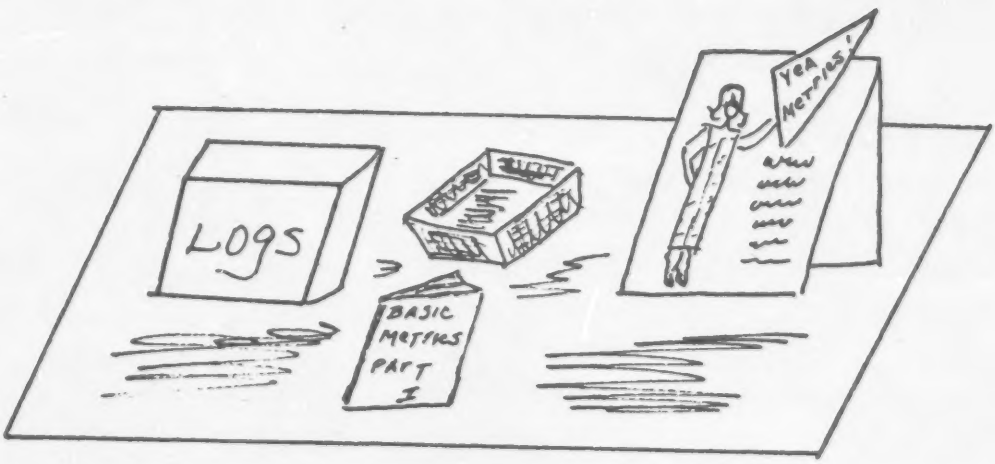
Students should be given a pre-test to determine which capsules in the sequence need to be done. All students will be required to complete Section One of Basic Metrics--Part 1. Since the time required for students to complete the first activity will vary, all students will not be at the same point in the capsule. Since space in some classrooms is limited, activities may take place at the students' desks. However, some activities will need to be completed at one of the satellite stations. You will want to limit the number of stations during a time period. Working time in the center will be 45 minutes per day for two or three weeks.

Students are directed by the capsule which they are using to complete activities. Directions are given in the capsule which tell them how to do the activity, where to go for materials and what to do with their work when they are finished.

The various stations of the center are spread out in the classroom to allow for flow of traffic and noise. A description of each station may be found on the following pages.

MANAGEMENT STATION

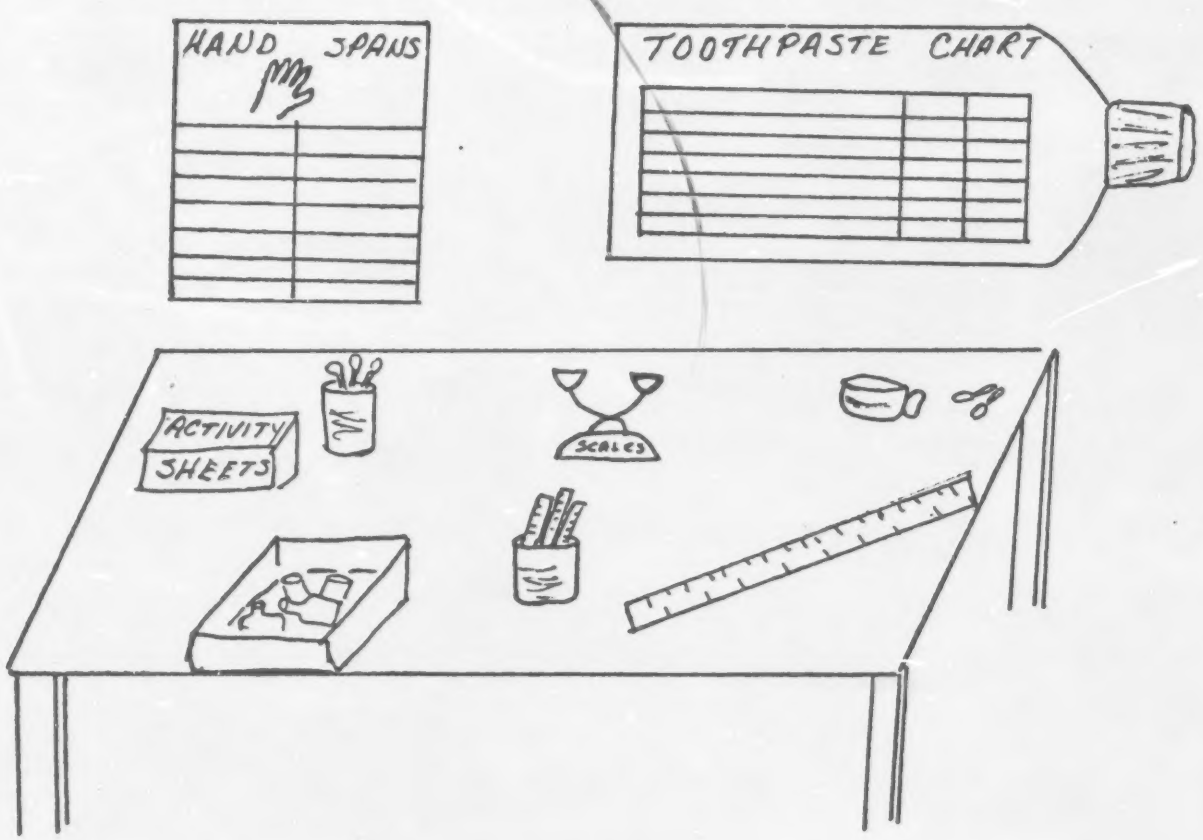
The Management Station consists of posters, a file for individual student logs, copies of the capsules Basic Metrics 1, 2, & 3, answer keys for activities, and a basket for completed work. A table top is used to display these items as shown below.



The Management Station

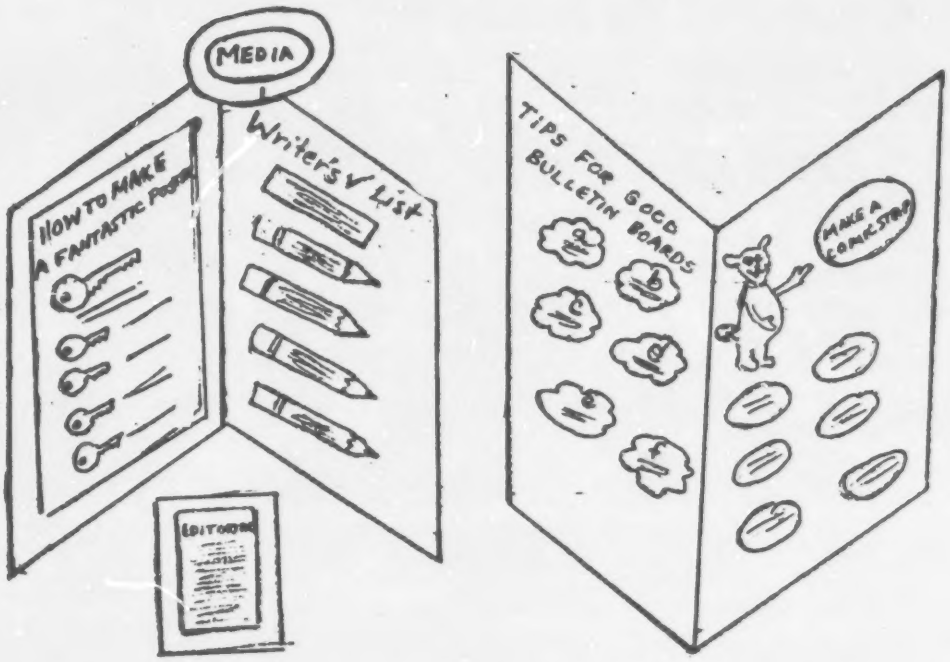
MEASURING STATION

The Measuring Station contains a box of assorted bottles, boxes, cans, popcorn, paper clips, etc. to be used for measurement activities. There is also a box for worksheets and games which go with the activities in this station. The station will contain rulers, scales, meter sticks, metric measuring cups and spoons for the various activities and the two charts described on the following page.



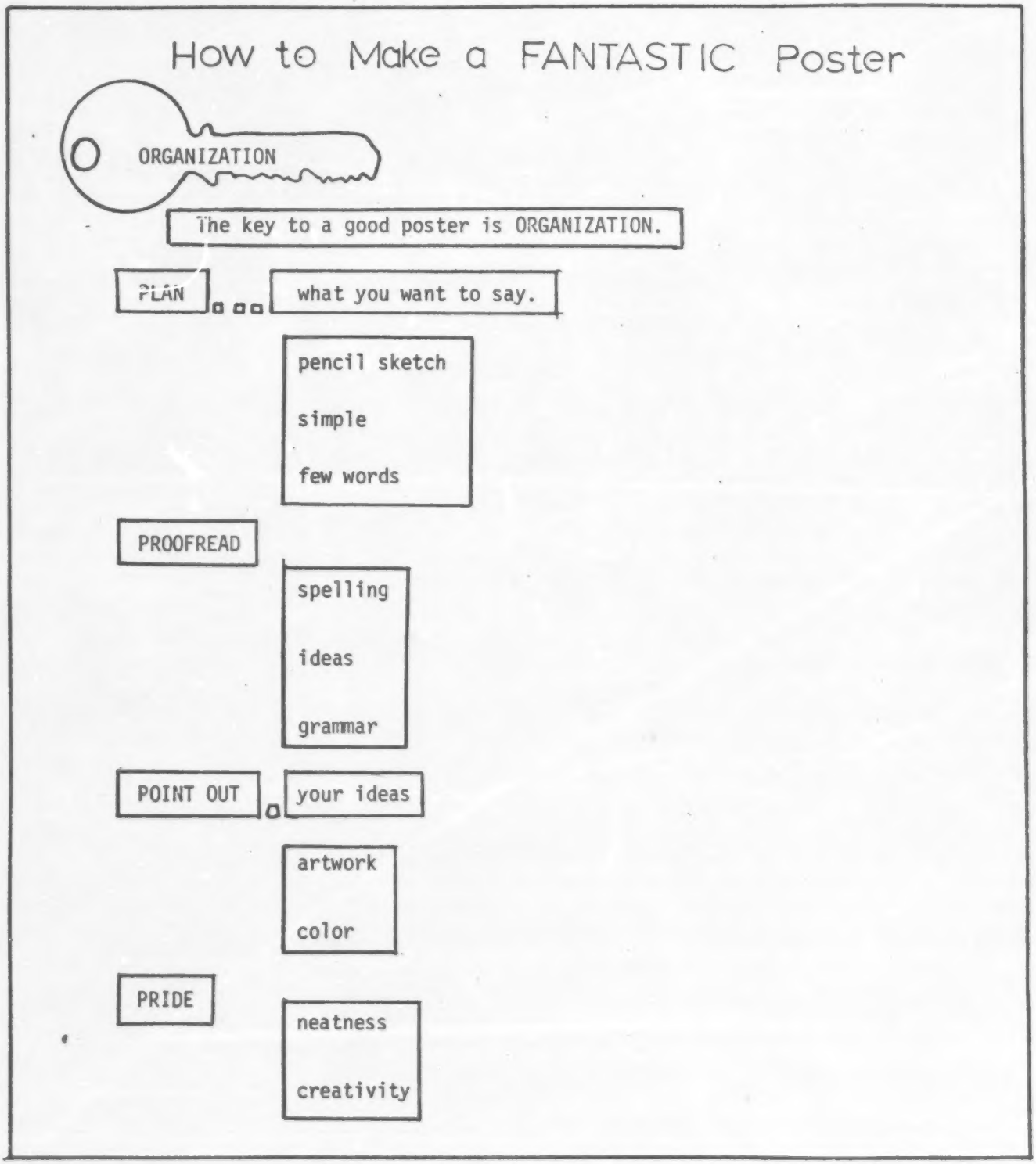
MEDIA STATION

This station is designed to be used as a teaching tool for students. It is constructed from mat board which has been hinged together with wide tape. Each section contains information needed by students to complete writing or display activities. Detailed descriptions of each section are given on the following pages.



How to Make a Fantastic Poster

This section of the Media Station is actually a poster which tells the student how to make a poster.



BEST COPY AVAILABLE

Writer's ✓ List

The Writer's ✓ List helps students proofread their work for errors. You may wish to have your students proofread their own work, or you may wish to use a buddy system for proofreading. Use construction paper and cut out the pencils. Mount the pencils and directions on the mat board. If the mat board and the pieces to be mounted are laminated first and put up with tape, the mat board may be reused for other centers.

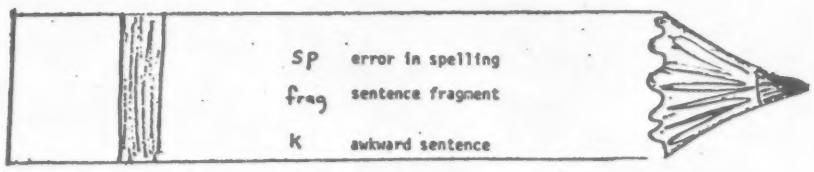
Have a classmate proof-read your paper for errors.

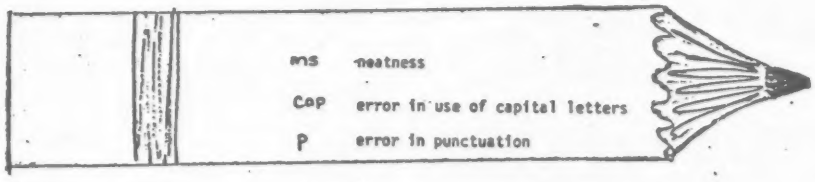
The proofreader will use the code below to mark each line in which there is an error.

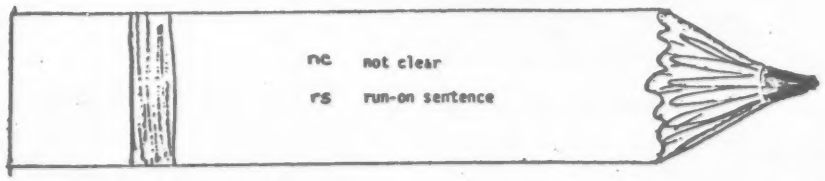
The proofreader will write the code letters in the left margin.

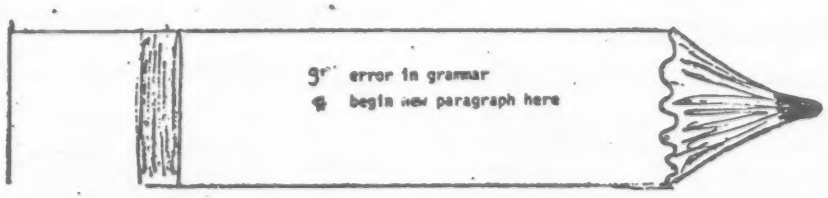
After the lines with errors have been marked, find each mistake and correct it.

Copy your writing over before handing it in or displaying it.



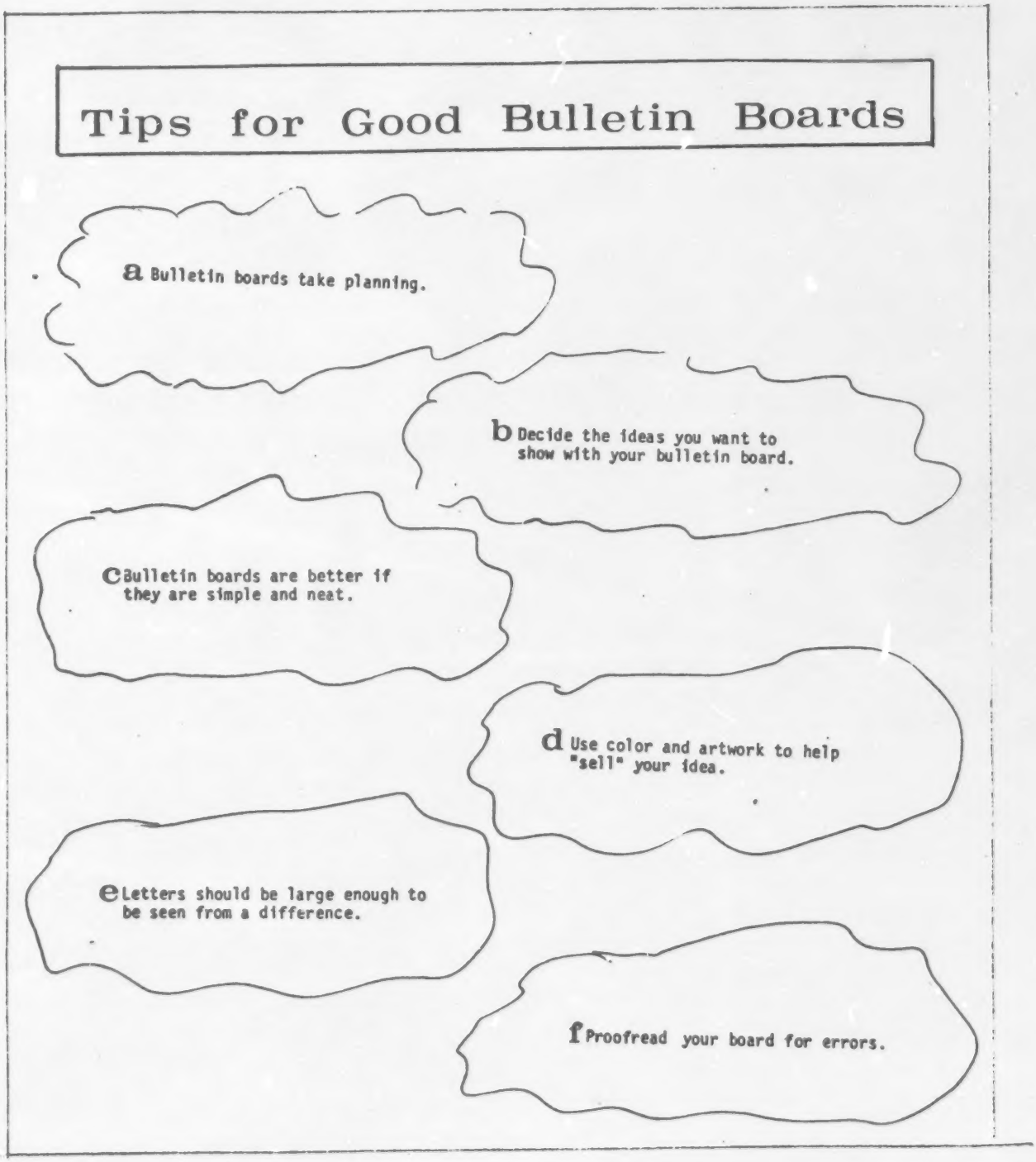






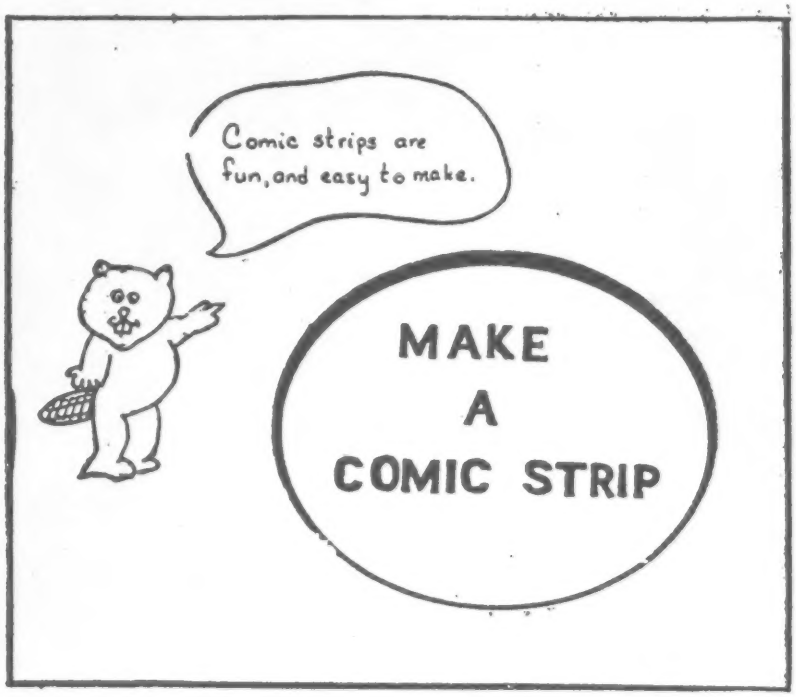
TIPS FOR GOOD BULLETIN BOARDS

The following tips may be typed on index cards and mounted on swatches of fabric or the fronts of discarded greeting cards. Use a piece of burlap and plastic stick-on letters to make the title strip for this section of the Media Station.


Tips for Good Bulletin Boards
a Bulletin boards take planning.
b Decide the ideas you want to show with your bulletin board.
c Bulletin boards are better if they are simple and neat.
d Use color and artwork to help "sell" your idea.
e Letters should be large enough to be seen from a difference.
f Proofread your board for errors.

MAKE A COMIC STRIP

Make a larger copy of the title poster. This may be laminated to protect it. Type the information below onto index cards or small circles. The cards or circles may be mounted on contrasting paper to make them stand out.



1- Plan your story before you begin drawing your cartoon.

2 Use the cartooning sheet that your teacher has provided at this station.

3 Sketch your cartoon in the comic strip squares.

4 Proofread your comic strip. Use the Writer's ✓ List.

5 Use line-line felt tip pens or colored pencils to go over your sketches.

USING ASSESSMENTS

Included in this capsule are a pre-test, a post-test and three self checks. A copy of all assessments is found in the appendix to this guide.

PRE-TEST: The student is directed by the capsule to take the pre-test at the appropriate time. A key is found in this guide. The pre-test should be used to indicate whether or not the student needs to complete this capsule.

SELF CHECKS: Self checks are included at the end of each section of the capsule. These let the student know how he/she is progressing. The self check at the end of Section Three will tell the student whether or not he/she is ready to take the post-test. This self check reviews all of the skills taught in the capsule. You will probably want to let students check their own work on self checks. Keys to these may be found in this guide.

POST-TEST: The post-test is designed to let you and the student know whether or not he/she has met the objectives of the capsule. A key is found in this guide.

Basic Metrics: Part 2
Pre-test

Name Key Date _____

Choose the correct answer and write it on the line to the left of the question.

c 1. The metric area of a 5 m x 8 m board is
   a. 18 m
   b. 40 m
   c. 40 m^2

b 2. The area of a box 4 cm long and 4 cm wide is
   a. 8 cm
   b. 16 cm^2
   c. 8 cm^2

a 3. Volume is
   a. the amount something holds.
   b. the distance around the container.
   c. the total area of the container.

c 4. The volume of a container that is 2 cm long, 4 cm wide and 6 cm deep is
   a. 12 cm^2
   b. 14 cm^3
   c. 48 cm^3

b 5. The abbreviation for liter is
   a. L
   b. l
   c. li

Basic Metrics: Part 2 Pre-test (Cont.)

a 6. Ml stands for
   a. miililiter.
   b. microliter.
   c. meterliter.

c 7. One liter equals
   a. 10 meters.
   b. 100 milliliters.
   c. 1000 milliliters.

b 8. 45 g = ____ kg
   a. 450
   b. .045
   c. .0045

a 9. Choose the larger prefix.
   a. hecto
   b. deca
   c. deci

b 10. Choose the larger prefix.
   a. centi
   b. deci
   c. milli

Basic Metrics: Part 2
Activity 7
Worksheet # 2-7

Key

Complete this worksheet. Turn it in to your teacher when you are finished.

Put the following list of prefixes in order starting with the largest and going to the smallest: deca, centi, kilo, deci, milli, hecto.

kilo hecto deca deci centi milli

Work the following problems. Put the correct answer in the blank.

1. 2.3 g = .0023 kg
2. 135 m = 13500 cm
3. 631 l = 631000 ml
4. 5.46 m = 54.6 dm
5. .01 g = 10 mg
6. .0006 mm = .0000006 m
7. 25.2 cm = 2.52 dm
8. .07 mg = 70 g
9. 60 kg = 60000 g
10. 4250 g = 4.250 kg

Basic Metrics: Part 2
Self Check: Section 1

Name Key Date _____

Complete the following self check. When you are finished, get the key from your teacher and check your paper. If you need more help in changing prefixes, see your teacher. If not, show this paper to your teacher and continue in the capsule.

1. Put the following prefixes in order from the largest to the smallest.

kilo	kilo
milli	hecto
deca	deca
centi	deci
deci	centi
hecto	milli

2. Circle the correct answer.
   To change from a larger to a smaller unit, you move the decimal point
   a. to the left.
   b. to the tenth.
   (c.) to the right.

Basic Metrics: Part 2
Activity 8
Worksheet # 2-8

Name Key Date _____

Use the information that you learned from the capsule to help you solve these consumer problems. Be sure to show your work. When you are finished turn your paper in to your teacher.

1. Mike wants to put wallpaper on one wall of his room. The paper he has chosen has an area of 2.7 m^2 in each roll. The wall that he wants to cover is 3 m long and 2.4 m high. How many rolls of paper will he need to buy?

The area of the wall is 7.2 m^2.
He will need to buy 3 rolls.

2. Karen is going to paint her room. She does not know how much paint to buy. Each gallon will cover and area of 27 m^2. The walls are the the following sizes: 2 walls are 3.6 m x 2.4 m and 2 walls are 3 m x 2.4 m. What is the total area of the room? (Hint: after you find the area of each wall, add the four walls together.) How many gallons of paint will Karen need to buy?

Total area of room 31.48 m^2 Number of gallons of paint 2

Basic Metrics: Part 2
Self Check--Section 2

Name Key Date _____

Complete this self check. Then get the key from your teacher and check your answers. Return the checked paper and the key to your teacher.

Circle the letter of the correct answer.

1. To find area you should use this formula
   a. length - width = area
   (b.) length x width = area
   c. length + width = area

2. The area of a porch that is 2 m long and 3 m wide is
   a. 6 m.
   (b.) 6 m^2.
   c. 6 m^3.

3. The area of a room that is 8 m long and 7 m wide is
   a. 15 m.
   b. 15 m^2.
   (c.) 56 m^2

Basic Metrics: Part 2
Self Check--Section Three

Name Key Date _____

Complete the following self check. Then get the key from your teacher and check your answers. If you had difficulty with any of these problems, see your teacher for help or go back and reread those sections of the capsule that deal with that question. When you feel that you understand the skills being taught in the capsule, ask your teacher for the post-test. Turn this paper and the answer key in to your teacher.

Choose the correct answer.

1. The formula for finding volume is
   a. length + width = volume
   (b.) length x width x depth = volume
   c length x width = volume

2. The unit of measure for finding volume in metrics is
   a. square units.
   b. feet.
   (c.) cubic units.

3. Volume is
   (a.) the amount of space that an object occupies.
   b. the perimeter of the container.
   c. the length of the container.

4. If a container measures 8 cm long, 9 cm deep, and 4 cm wide, its volume is
   a. 21 cm
   b. 288 cm
   (c.) 288 cubic centimeters

Basic Metrics: Part 2
Self Check--Section Three (Cont.)

5. A liter is a little larger than a
   a. pint.
   b. quart.
   c. gallon.

6. One milliliter is
   a. 10 times larger than 1 liter.
   b. 100 times smaller than 1 liter.
   c. 1000 times smaller than 1 liter.

Basic Metrics: Part 2
Post-test

Name Key Date _____

Match the correct symbol in Column B to the word in Column A. Put the letter of the correct answer on the line in front of the number.

e	1. milliliter	a. cm^2
f	2. meter	b. l
b	3. liter	c. mm^3
a	4. square centimeter	d. mg
c	5. cubic millimeter	e. ml
		f. m

Solve the following problems. Show your work.

6. How much liquid does a container the following size hold: 10 cm long, 6 cm wide, 5 cm deep?

$300\ cm^3$

7. The length of a board is 12 cm., The width is 24 cm. What is the area of the board?

$288\ cm^2$

8. Convert 5.41 meters to centimeters. 541cm

9. Change 864 milligrams to grams. .864g

10. Find the volume of a container that is 5 cm long, 5 cm wide and 5 cm deep.

$125 cm^3$

11. What is the area of a wall that is 8 m by 12 m?

$96 m^2$

BIBLIOGRAPHY

Books

1. Bowles, Richard D.; Make Way for Metrication; Lerner Publication Co.; Minneapolis, Minnesota; 1975.

2. Kelly, Gerald W.; The Metric System Simplified; Sterling Publishing Co. Inc.; New York; 1976.

3. Ross, Frank Jr.; The Metric System; S. G. Phillips--Publisher; New York; 1974.

4. Young, Lorelle and Carole Bielefeld; Hometrics; Editor--Patricia M. Horton; Publisher--Enrich, Inc.; 1977.

Phamplets

1. "Going Metrics" John E. Roller, Director
   Educational Service Center
   Box 45308
   Tulsa, OK 74145

2. "Metrics" Elinor Anderson and Mildred Walker
   Cooperative Extension Service
   Kansas State University
   Manhattan, KS

3. "Teaching Metrication" Sears Roebuck and Co.
   Consumer Information Services-D/703
   Sears Tower
   Chicago, IL 60684

Films

1. "A Metric America" Aims Films Media Services, Inc.
   626 Justin Avenue
   Glendale, California 91201

   16 mm for jr.-sr. high Time- 16 minutes

   Conversion, saving of time and effort, conversion of money, a share of international market place.

2. "Metric Measurement II" Journal Films
   909 West Diversey Parkway
   Chicago, IL 60614

   16 mm for jr. high Time- 15 minutes
   Measuring, comparison, and base 10.

APPENDIX

This appendix contains copies of all worksheets and assessments. These copies may be used to make your own classroom quantity copies. To use, unstaple the sides of the teacher's guide and remove the worksheet and assessment pages. Restaple the remaining pages of the teacher's guide.

Basic Metrics: Part 2
Record Sheet

Activities	Sections to be completed	Date Completed	Comments
Pre-test Score			
Section One			
Activity 7			
Self Check			
Section Two			
Activity 8			
Activity 9			
Activity 10			
Self Check			
Section Three			
Activity 11			
Activity 12			
Activity 13 (Choose one.)			
Activity 14 (Choose one.)			
Activity 15 (Choose one.)			
Activity 16 (Choose one.)			
Self Check			
Post-test Score			
Quest			

Basic Metrics: Part 2
Pre-test

Name _____ Date _____

Choose the correct answer and write it on the line to the left of the question.

_____ 1. The metric area of a 5 m x 8 m board is
   a. 18 m
   b. 40 m
   c. 40 m^2

_____ 2. The area of a box 4 cm long and 4 cm wide is
   a. 8 cm
   b. 16 cm^2
   c. 8 cm^2

_____ 3. Volume is
   a. the amount something holds.
   b. the distance around the container.
   c. the total area of the container.

_____ 4. The volume of a container that is 2 cm long, 4 cm wide and 6 cm deep is
   a. 12 cm^2
   b. 14 cm^3
   c. 48 cm^3

_____ 5. The abbreviation for liter is
   a. L
   b. l
   c. li

Basic Metrics: Part 2 Pre-test (Cont.)

_____ 6. Ml stands for
   a. milliliter.
   b. microliter.
   c. meterliter.

_____ 7. One liter equals
   a. 10 meters.
   b. 100 milliliters.
   c. 1000 milliliters.

_____ 8. 45 g = _____ kg
   a. 450
   b. .045
   c. .0045

_____ 9. Choose the larger prefix.
   a. hecto
   b. deca
   c. deci

_____ 10. Choose the larger prefix.
   a. centi
   b. deci
   c. milli

Basic Metrics: Part 2
Activity 7
Worksheet # 2-7

Name _____

Complete this worksheet. Turn it in to your teacher when you are finished.

Put the following list of prefixes in order starting with the largest and going to the smallest: deca, centi, kilo, deci, milli, hecto.

_____ _____ _____ _____ _____ _____

Work the following problems. Put the correct answer in the blank.

1. 2.3 g = _____ kg

2. 135 m = _____ cm

3. 631 l = _____ ml

4. 5.46 m = _____ dm

5. .01 g = _____ mg

6. .0006 mm = _____ m

7. 25.2 cm = _____ dm

8. .07 mg = _____ g

9. 60 kg = _____ g

10. 4250 g = _____ kg

Basic Metrics: Part 2
Self Check: Section 1

Name _____ Date _____

Complete the following self check. When you are finished, get the key from your teacher and check your paper. If you need more help in changing prefixes, see your teacher. If not, show this paper to your teacher and continue in the capsule.

1. Put the following prefixes in order from the largest to the smallest.

kilo	_____
milli	_____
deca	_____
centi	_____
deci	_____
hecto	_____

2. Circle the correct answer.
   To change from a larger to a smaller unit, you move the decimal point
   a. to the left.
   b. to the tenth.
   c. to the right.

Basic Metrics: Part 2
Activity 8
Worksheet # 2-8

Name _____ Date _____

Use the information that you learned from the capsule to help you solve these consumer problems. Be sure to show your work. When you are finished turn your paper in to your teacher.

1. Mike wants to put wallpaper on one wall of his room. The paper he has chosen has an area of $2.7\ m^2$ in each roll. The wall that he wants to cover is 3 m long and 2.4 m high. How many rolls of paper will he need to buy?

2. Karen is going to paint her room. She does not know how much paint to buy. Each gallon will cover and area of $27\ m^2$. The walls are the the following sizes: 2 walls are 3.6 x 2.4 m and 2 walls are 3 m x 2.4 m. What is the total area of the room? (Hint: after you find the area of each wall, add the four walls together.) How many gallons of paint will Karen need to buy?
Total area of room _____ Number of gallons of paint _____

Basic Metrics: Part 2
Self Check--Section 2

Name _____ Date _____

Complete this self check. Then get the key from your teacher and check your answers. Return the checked paper and the key to your teacher.

Circle the letter of the correct answer.

1. To find area you should use this formula
   a. length - width = area
   b. length x width = area
   c. length + width = area

2. The area of a porch that is 2 m long and 3 m wide is
   a. 6 m.
   b. 6 m^2.
   c. 6 m^3.

3. The area of a room that is 8 m long and 7 m wide is
   a. 15 m.
   b. 15 m^2.
   c. 56 m^2

Basic Metrics: Part 2
Self Check--Section Three

Name _____ Date _____

Complete the following self check. Then get the key from your teacher and check your answers. If you had difficulty with any of these problems, see your teacher for help or go back and reread those sections of the capsule that deal with that question. When you feel that you understand the skills being taught in the capsule, ask your teacher for the post-test. Turn this paper and the answer key in to your teacher.

Choose the correct answer.

1. The formula for finding volume is
   a. length + width = volume
   b. length x width x depth = volume
   c length x width = volume

2. The unit of measure for finding volume in metrics is
   a. square units.
   b. feet.
   c. cubic units.

3. Volume is
   a. the amount of space that an object occupies.
   b. the perimeter of the container.
   c. the length of the container.

4. If a container measures 8 cm long, 9 cm deep, and 4 cm wide, its volume is
   a. 21 cm
   b. 288 cm
   c. 288 cubic centimeters

Basic Metrics: Part 2
Self Check--Section Three (Cont.)

5. A liter is a little larger than a
   a. pint.
   b. quart.
   c. gallon.

6. One milliliter is
   a. 10 times larger than 1 liter.
   b. 100 times smaller than 1 liter.
   c. 1000 times smaller than 1 liter.

Basic Metrics: Part 2
Post-test

Name _____ Date _____

Match the correct symbol in Column B to the word in Column A. Put the letter of the correct answer on the line in front of the number.

Column A	Column B
_____ 1. milliliter	a. cm^2
_____ 2. meter	b. l
_____ 3. liter	c. mm^3
_____ 4. square centimeter	d. mg
_____ 5. cubic millimeter	e. ml
	f. m

Solve the following problems. Show your work.

6. How much liquid does a container the following size hold: 10 cm long, 6 cm wide, 5 cm deep?

7. The length of a board is 12 cm., The width is 24 cm. What is the area of the board?

8. Convert 5.41 meters to centimeters.

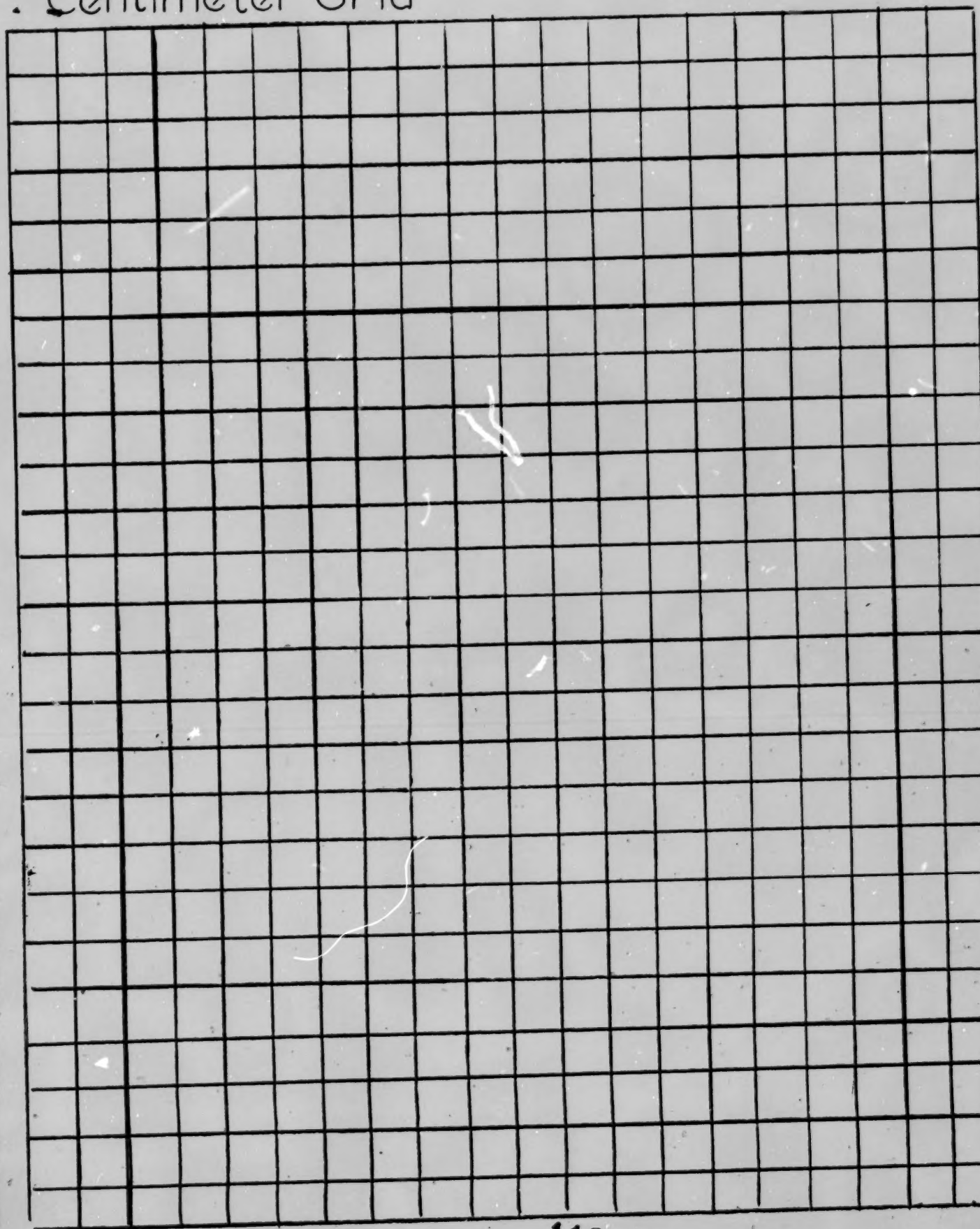
9. Change 864 milligrams to grams.

Post-test (cont.)

10. Find the volume of a container that is 5 cm long, 5 cm wide and 5 cm deep.

11. What is the area of a wall that is 8 m by 12 m?

Centimeter Grid



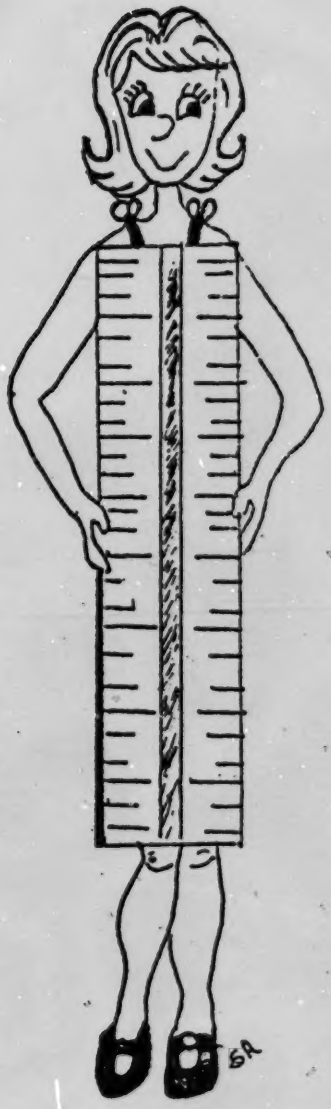
BASIC METRICS

PART 2

Student Materials

Developed By:
Joan Noyes

As Part of
Project COST
ESEA Title IV
Kansas State Dept. of Education
USD 449
Easton, KS 66020

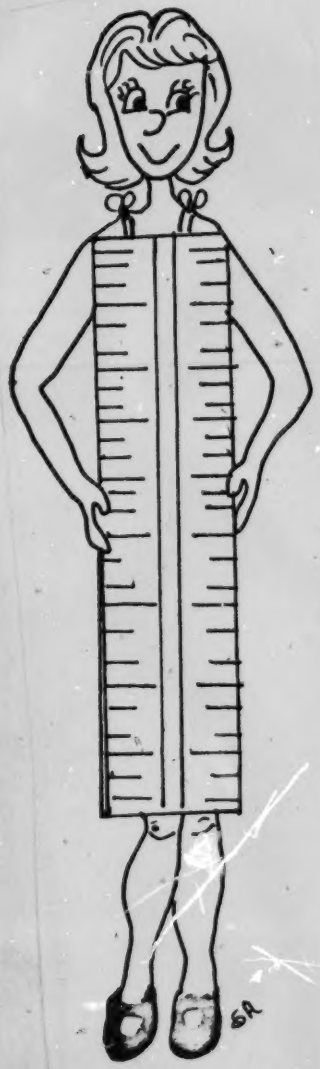


Illustrated by Sherry Anderson

INTRODUCTION

Before you start Basic Metrics: Part 2, you should have already completed Basic Metrics: Part 1. You will have learned the advantages of the metric system to consumers and how to measure length.

In this capsule you will learn to change prefixes and measure area and volume/capacity. Let's get involved in Basic Metrics: Part 2 and jump smack dab into to middle and find out more about the world of METRICS.



Let's explore metrics with Millie Meter.

OBJECTIVES

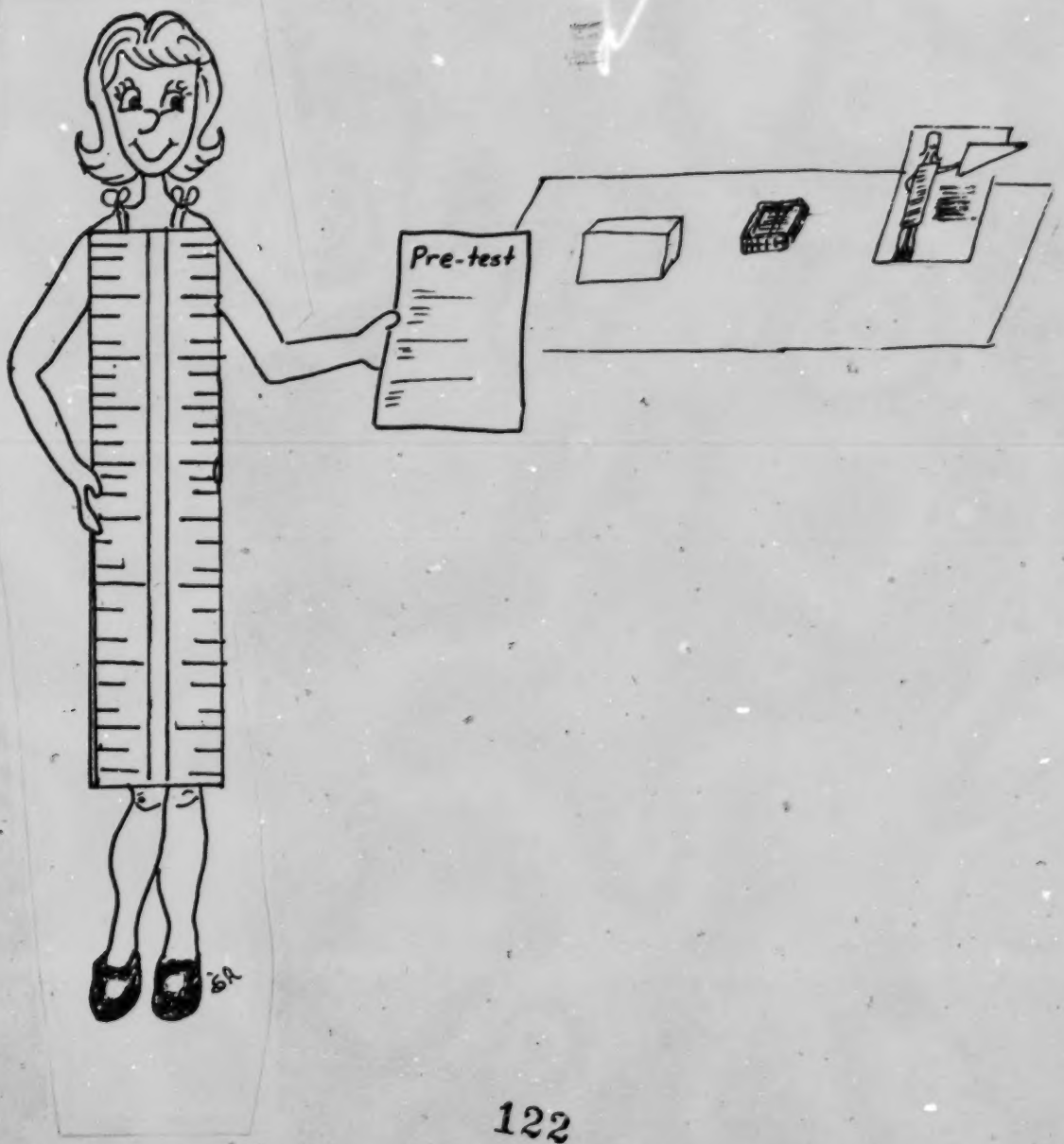
After you have completed this capsule, you will be able to:

identify metric terms and symbols that are used in measuring area and volume.

apply metric principles to solve consumer problems in measuring area and volume.

PRE-TEST

Go to the Metric Center and get the Pre-test-Part 2. Complete the test, then turn it in for your teacher to check and see which sections of the capsule you need to do.

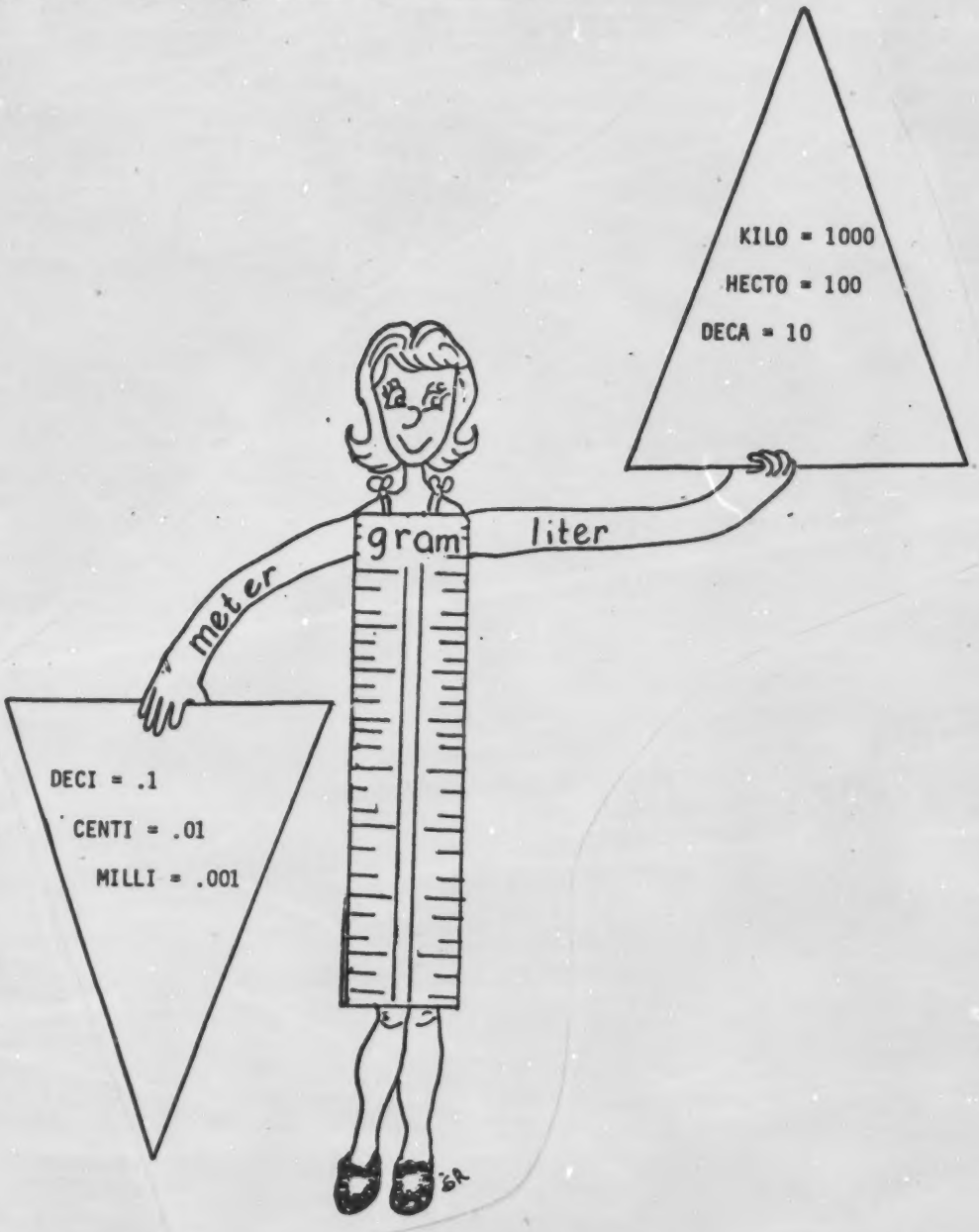


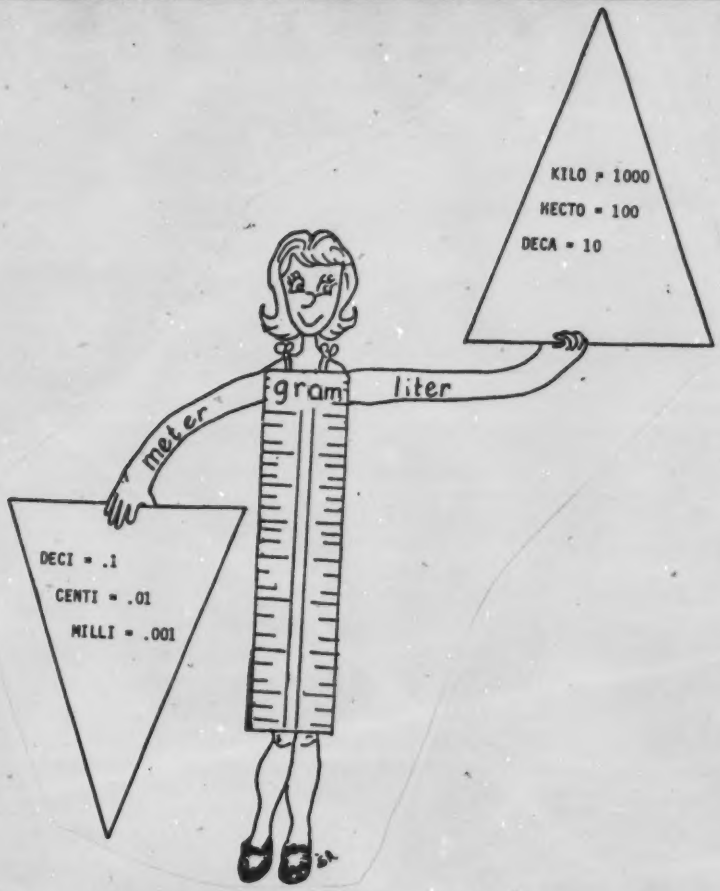
SECTION ONE

CHANGING VALUES WITH PREFIXES

KILOmeter	KILOliter
HECTOmeter	HECTOliter
DECAmeter	DECAliter
meter	liter
DECImeter	DECIliter
CENTImeter	CENTIliter
MILLImeter	MILLIliter

In this section you will be learning to change values with prefixes. When you need to change from one value to another value in the same unit, all you need to do is change the decimal point. Below is a chart of the prefixes from large units to small units.





If you need to go to a smaller unit, move the decimal point to the right the same number of places as the number of steps you move down on the chart.

For example:

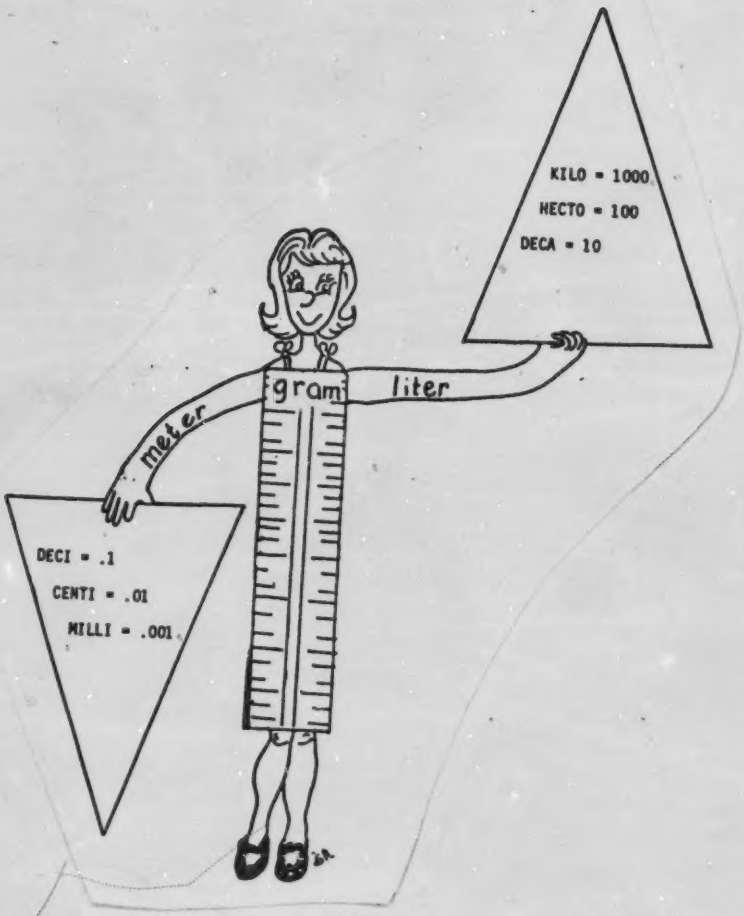
If you want to change from grams to milligrams, you would move the decimal point to the right because you are changing to a smaller unit. You count down on the chart from grams to milligrams. That is three (3) spaces, so move the decimal point over three (3) places to the right.

1 gram = ? milligrams

1 space = 1.0 = 10 decigrams

2 spaces = 10.0 = 100 centigrams

3 spaces = 100.0 = 1000 milligrams

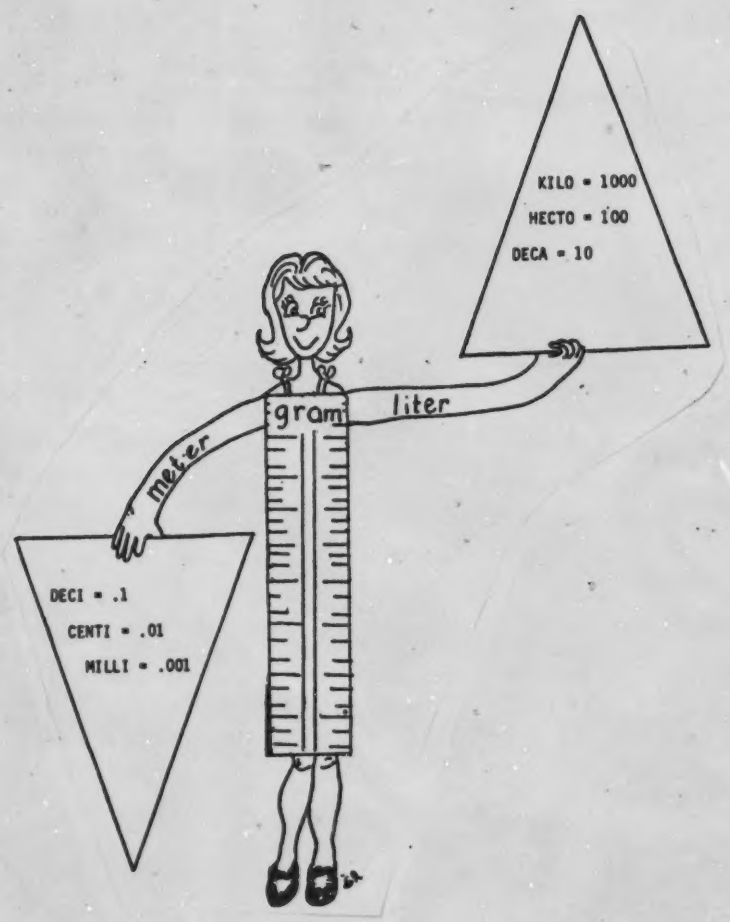


Let's change 1.4 meters to centimeters. To do this, how many steps down on the chart do you go to get from meter to centimeter? You have moved two (2) steps. This means that you will need to move the decimal point two (2) spaces to the right. See how it's done?

1.4 meters = ? centimeters

1 space = 1.4. meters = 14 decimeters

2 spaces = 14.0. decimeters = 140 centimeters

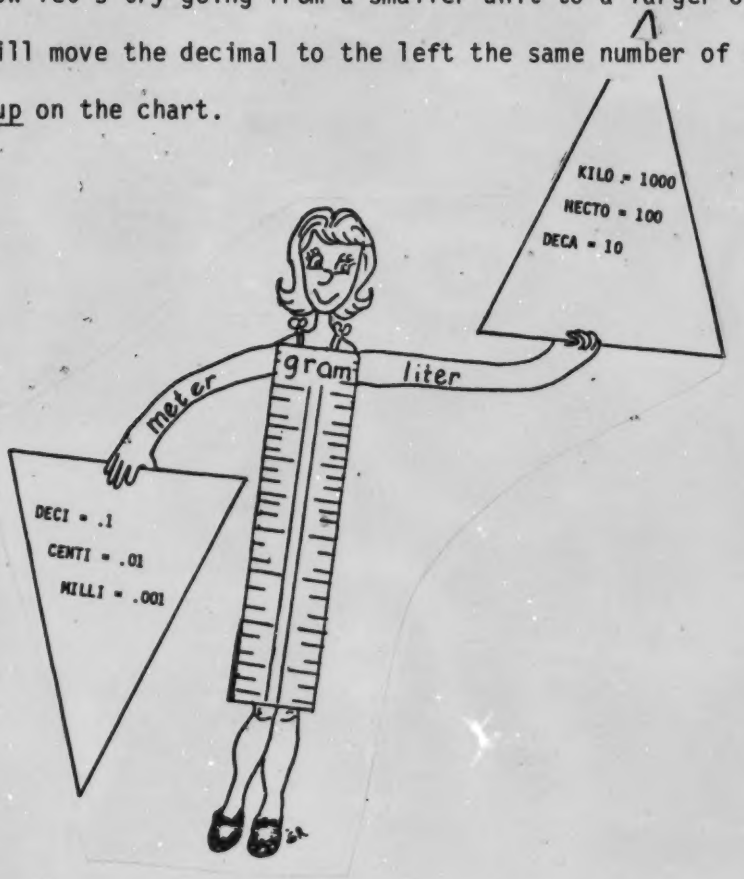


Let's do one more example of going from a larger unit to a smaller one. Change 2.14 centimeters to millimeters. How many steps do you go down on the chart? Yes, you go one (1) step, so move the decimal to the right 1 space. The answer is 21.4 millimeters.

2.14 centimeters = ? millimeters

1 space = 2.1.4 centimeters = 21.4 millimeters

Now let's try going from a smaller unit to a larger one. In this case you will move the decimal to the left the same number of spaces as you move up on the chart.

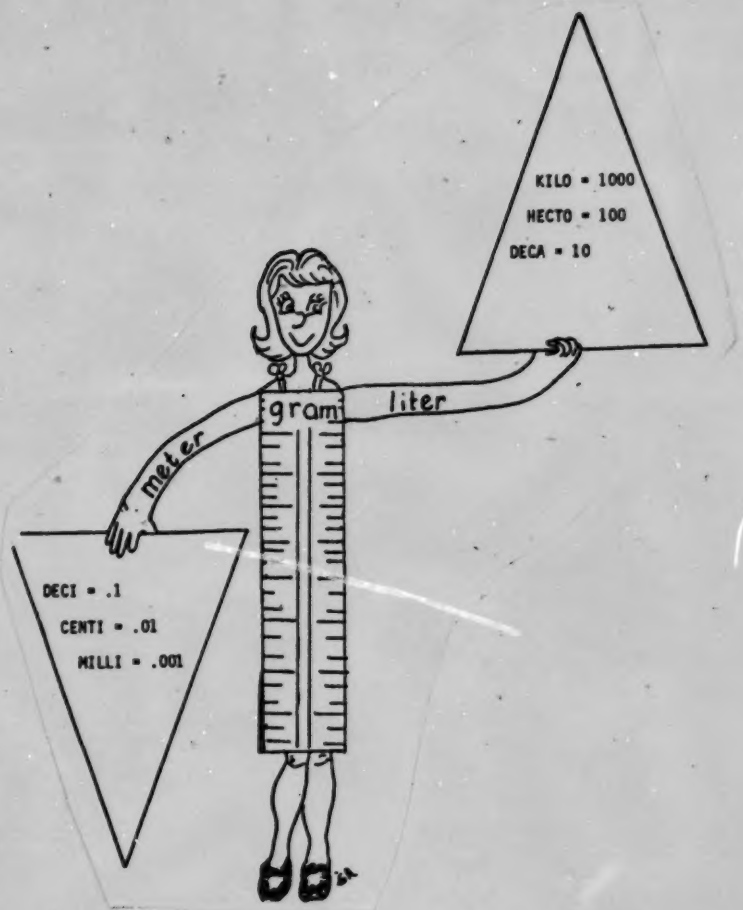


If you wanted to change 250 centimeters to meters, you would move the decimal point to the LEFT two spaces. This is because you moved up two (2) steps on the chart from centimeter to meter. If you check the chart, you see that a meter is 100 times larger than a centimeter.

250 centimeter = ? meters

1 space = 25.0. centimeters = 25 decimeters

2 space = 2.5. decimeters = 2.5 meters



Let's change 51 milliliters to liters. On the chart you would move up three (3) steps, so move the decimal point three (3) places to the LEFT. That gives you .051 liters.

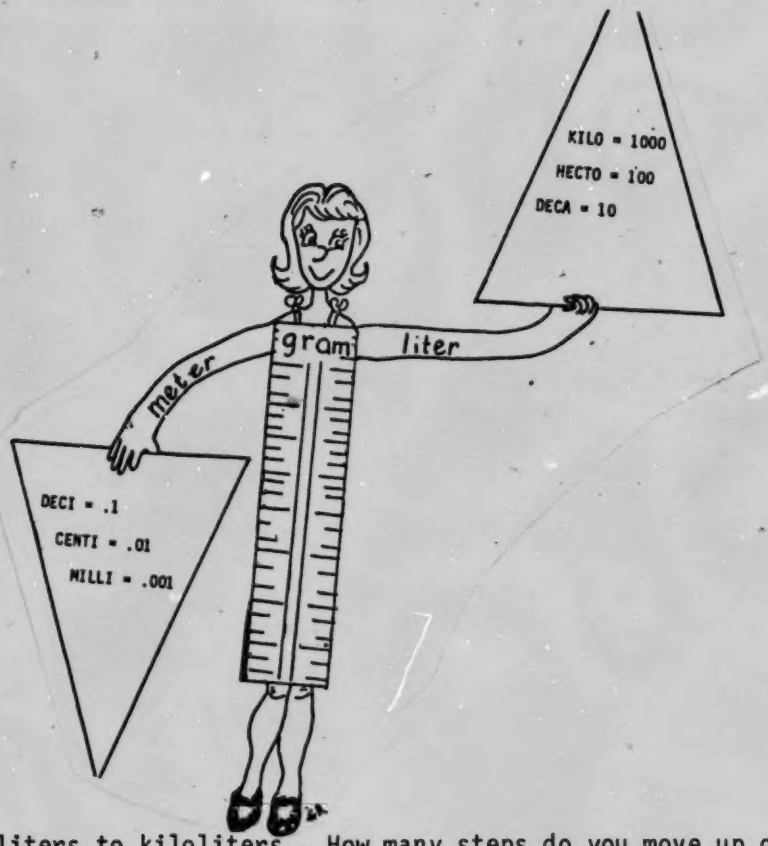
51 milliliters = ? liters

1 space = 5.1. milliliters = 5.1 centiliters

2 spaces = .5.1 centiliters = .51 deciliters

3 spaces = .0.51 deciliters = .051 liters

Let's do one more example, then you will be ready to try some problems on your own.



Change 621 liters to kiloliters. How many steps do you move up on the chart? Three (3) is right, so move the decimal over three (3) places to the LEFT. This makes your answer .621 kiloliters.

621 liters = ? liloliters

1 space = 62.1 liters = 62.1 dekaliters

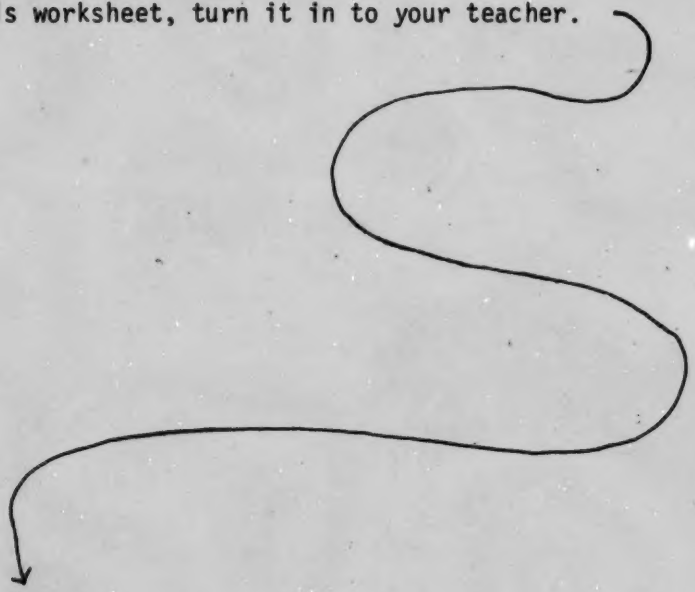
2 spaces = 6.2.1 dekaliters = 6.21 hectoliters

3 spaces = .6.21 hectoliters = .621 kiloliters

ACTIVITY

DO THE FOLLOWING ACTIVITY.

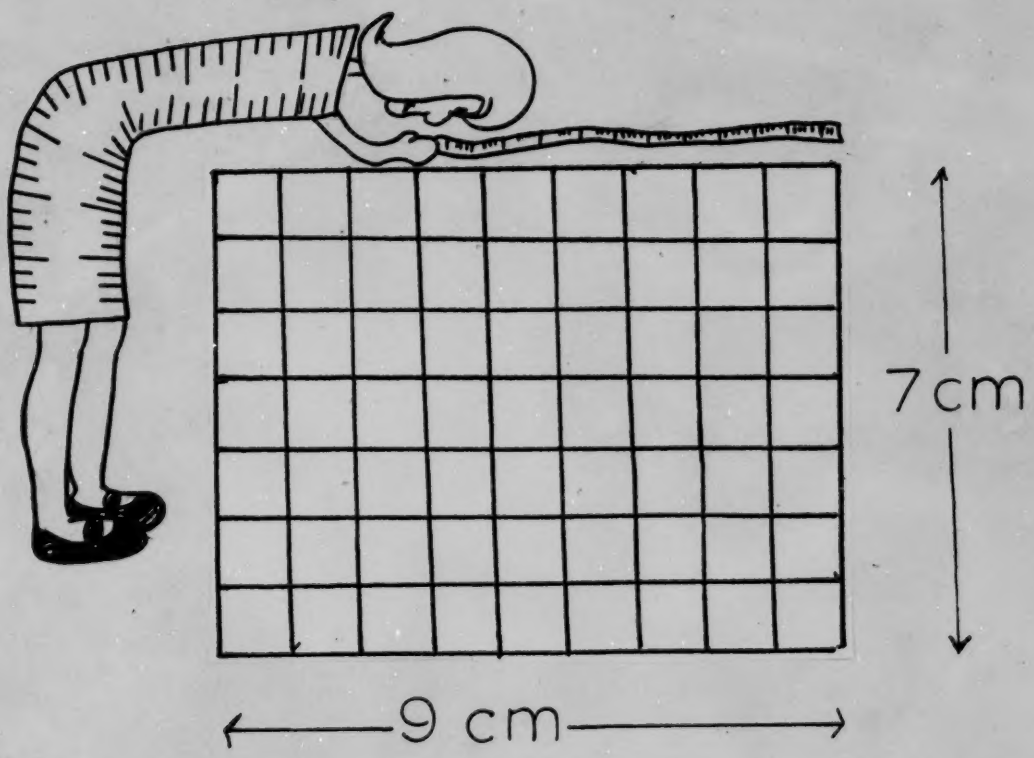
7. Go to the Metric Center and get Worksheet #2-7. When you have completed this worksheet, turn it in to your teacher.



When you have finished this activity, go to the Metric Center and get the Self Check: Changing Values of Prefixes. When you have finished, get the key from your teacher and check your paper. Then give your paper to your teacher.

SECTION TWO

AREA



$9cm \times 7cm = 63cm^2$

WOW!!!That was a lot of information, wasn't it? I'll bet you understand how to change those prefixes, now. It is really very easy if you just remember to move the decimal RIGHT to get smaller and LEFT to get larger.

Now let's go a little further into metrics and learn how to measure area. You probably already know that to find the area of something, you need to multiply the length times the width. But who cares?

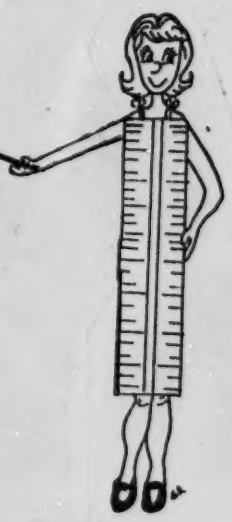
If you wanted to find out how much carpet or floor covering to buy to replace that antique in your room, then you would need to be able to find the area of your room. If you decide to cover the holes in your wall with paneling, but you don't know how much to buy, then you need to know how to find the area of the wall or walls.

As consumers we often have to figure area. Finding area is much easier using metrics units, because you do not have to deal with fractions.

AREA:
length x width = square units

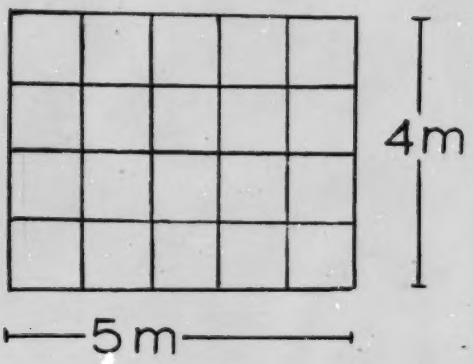
square = sq.

sq. m	sq. mm
sq. cm	sq. km



Let's do a problem that many consumers face. Sarah wants to buy new carpet for her room. The room is 5 meters long and 4 meters wide. How many square meters of carpet will she need?

The drawing below shows what is happening.

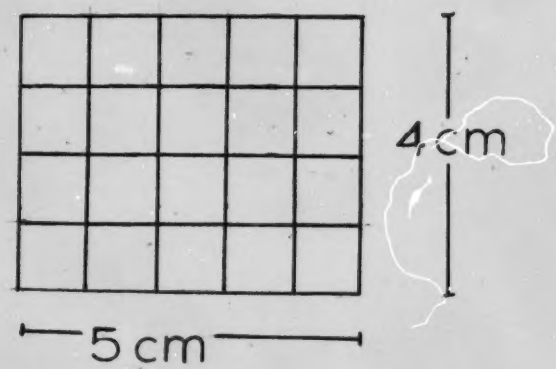


Each square represents 1 square meter. Sarah could just count the squares to get the answer, but there is a faster way.

To find area, Sarah can just multiply the length by the width. In this case:

LENGTH	X	WIDTH	=	AREA
5	X	4	=	20 sq. m or 20 m^2

Let's say that you wanted to find out how much surface or area that a playing card takes up. The playing card is 3 cm wide and 4 cm long. How do you find the area that the card takes up? Multiply 3 cm and 4 cm. This equals 12 sq. cm or 12 cm^2. Here is how it would look on a centimeter grid.



Now there are probably very few times that you will need to know how to find the area of a playing card, but the same process can be used to find the area of any flat surface. The same process is used whether you are measuring in units of meters, centimeters, millimeters, kilometers, or hectares. By the way, hectares is the unit you use when you are measuring land. 1000 m^2 equals 1 hectare or about 2½ acres in the American system of measuring land.

ACTIVITIES

DO ALL OF THE FOLLOWING ACTIVITIES:

8. Go to the Metric Center and get Worksheet #2-8. Complete this worksheet and turn it in to your teacher.

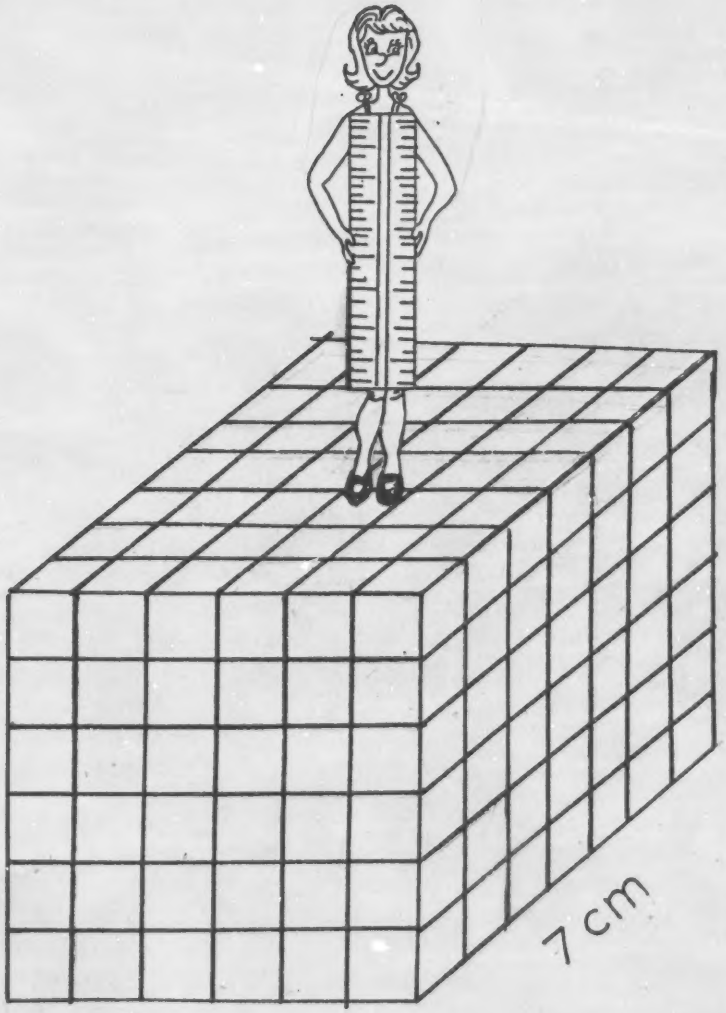
9. Using the centimeter grid paper that you find in the Measuring Station, place a square or rectangular object on the paper and trace around it. Count the number of squares lengthwise and the number of squares across that the object takes up. Multiply the number of squares lengthwise times the number of squares across to find the area of that object. Check your answer by counting each object that the object is in. Pick 5 more objects and repeat this process. Be sure to write down the object that you are measuring and the area that it has. Turn your paper in when you are done.

10. For this activity you will need a piece of centimeter grid paper which you will find in the Measuring Station. Draw a square that is 1 cm on each side, and determine its area. Then draw a square for each of the following lengths and determine their areas: 2 cm, 3 cm, 4 cm, and 5 cm. When you are done, turn in your sheet of grid paper to be checked.

When you have finished the activities on area, go to the Metric Center and get the Self Check: Area. Complete the self check. Then get the key from your teacher and check your paper. Return the checked paper and the key to your teacher.

SECTION THREE

VOLUME/CAPACITY



6 cm

$6cm \times 6cm \times 7cm = 252cm^3$

The volume of an object is the amount of space that it takes up. Its capacity is the amount that it will hold. We measure volume and capacity in the same way.

LENGTH	X	WIDTH	X	DEPTH	=	VOLUME/CAPACITY
l	x	w	x	d	=	volume/capacity

Volume and capacity are measured in cubic units because we are multiplying three dimensions together (length, width and depth).

Remember that in metrics you do not put periods after the abbreviations unless it is the end of a sentence. Also remember that area is measured in square units and volume is measured in cubic units.

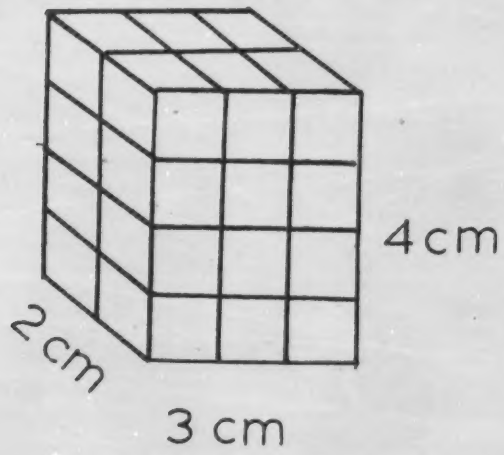
You would use the volume/capacity formula (l x w x d) to figure such things as the amount of gas in a can, the liquid a container could hold, etc.

VOLUME/CAPACITY: CUBIC UNITS

length x width x depth = $units^3$

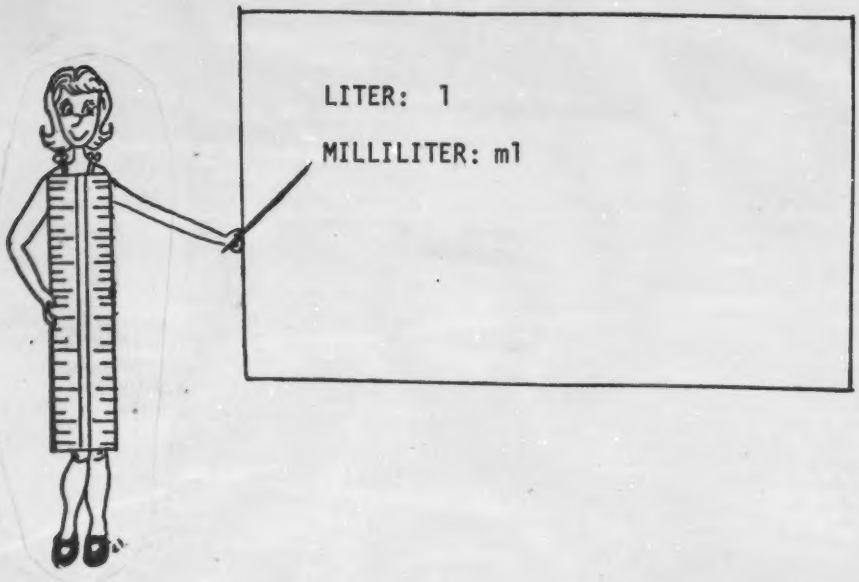
Here is a problem that you might encounter concerning volume/capacity.

You have a container 3 cm long, 4 cm wide and 2 cm deep. What is the volume of this container? Take 3 cm x 4 cm x 2 cm = 24 cm^3.



You can also find the volume of liquids by measuring in liters. The abbreviation for liters is l. A liter is slightly larger than a quart. To measure in liters you will need a special liter measure. It is usually plastic or glass with marks on it to indicate the liters. If you pour milk into the measure and the liquid come to the mark that indicates 2 liters, then you have 2 liters of milk.

Some items that are measured in liters are milk, juice, gasoline, paint and pop.



For amounts smaller than a liter, we measure in milliliters (ml). If a liter is divided into a thousand equal parts, each part is called a milliliter. So, 1 l = 1000 ml or 1 ml = .0001 l. A milliliter is about $^{1}/_{5}$ teaspoon. As you can see, that is a very small amount.

Some things that are measured in milliliters are medicines, cottage cheese, sauces, and ingredients in recipes. Kitchen measures are sized in milliliters.

Do you remember when we said that the metric measures are interrelated? Well, 1 ml = 1 cm^3. If you filled a centimeter cube with water it would be the same amount of water as if you were filling a milliliter measure.

ACTIVITIES

DO EITHER ACTIVITY 11 OR 12.

11. Go to the Measuring Station and get a metric measure and a ½ gallon milk carton. Measure the length, width and depth of the carton in centimeters. Find the volume of the carton. See if your mathematical answer is the same as when you fill it with centimeter blocks. Report your findings to your teacher in writing.

12. Measure two containers from the Measuring Station that have length, width and depth. Find the volume of these two containers. List the sizes on a sheet of paper and show your work.

CHOOSE EITHER ACTIVITY 13 OR 14.

13. Choose 3 containers from the Measuring Station. Find the volume of each in liters using the liter measure and water. Make a sketch of the container on a sheet of drawing paper. Record the volume in liters. Turn your paper in to your teacher.

14. Prepare a comic strip showing how to measure in liters. When you have finished the cartoon, post it on the bulletin board to be read by your teacher and classmates. You will find information on making comic strips at the Media Station.

CHOOSE EITHER ACTIVITY 15 OR 16.

15. Make a collection of containers and labels which show the amount of the contents in either liters or milliliters. You should have at least ten items in your collection. Think of a way to display your collection. For example, you could make a tabletop display or a three dimensional poster, or a diorama, etc. Use your imagination. Try to make your display different from those of your classmates doing this activity.

16. From old newspapers or magazines that can be found in the Media Station or at home, find 5 things that have a milliliter unit of measure. Paste these pictures on a piece of paper and turn your paper in to be checked.

When you have finished the activities on volume and capacity, go to the Metric Center and get the Self Check: Volume/Capacity. Complete the self check. Then get the key from your teacher and check your paper. Return your checked paper and the key to your teacher. If your self check indicates that you need more practice, go back and complete one of the activities in this capsule in the section where you are having difficulty. Then take the post-test.

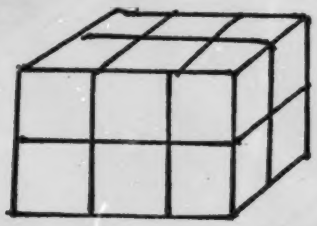
If after taking the self check you think that your are ready for the post-test, see your teacher. Be sure to get the post-test which is marked "Basic Metrics: Part 2". When you finish it, return it to your teacher to be checked.

On the next page is a Quest activity. You may choose to do this activity if you would like to explore more about metrics.

QUEST

To do this activity you will need 12 centimeter cubes which you will find in the Measuring Station and a piece of paper. You will write your answers on the paper. Follow the directions below. When you have finished turn your paper in to your teacher and discuss your results with him/her.

a. Place 12 cubes as in the picture.



b. How many cubes 1 cm x 1 cm are on the outside surface of the figure. (Don't forget the bottom.)

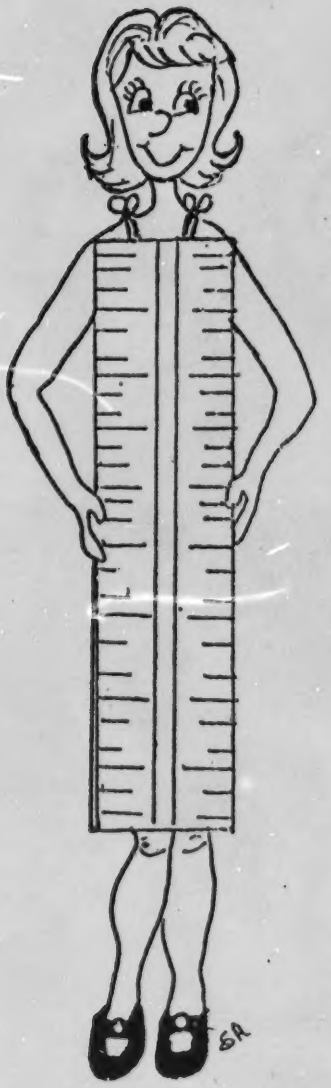
c. Change the shape of the figure. Did the surface area remain the same? Draw a picture of the new figure.

d. What would be the largest area that could be exposed? Draw a picture to illustrate.

e. What would be the smallest area that could be exposed? Draw a picture to illustrate.

BASIC METRICS

PART 3



Developed By:
Joan Noyes

As Part of
Project COST
ESEA Title IV
Kansas State Dept. of Education
USD 449
Easton, KS 66020

Illustrated by

Sherry Anderson

Teacher's Guide

TABLE OF CONTENTS

Package Resume ---------- 1
Objectives ---------- 2
Materials List ---------- 3
Using Basic Metrics Capsules and the Center ---------- 4
Management Station ---------- 5
Measuring Station ---------- 6
Media Station ---------- 7
How to Make a Fantastic Poster ---------- 8
Writer's Cramp List ---------- 9
Tips for Good Bulletin Boards ---------- 10
Make a Comic Strip ---------- 11
Notes for the Teacher ---------- 12
Keys to Activities
- Pre-test ---------- 14
- Worksheet #3-17 ---------- 16
- Worksheet #3-19 ---------- 17
- Worksheet #3-20 ---------- 18
- Self Check-Section One ---------- 19
- Worksheet #3-22 ---------- 20
- Worksheet #3-23 ---------- 21
- Self Check-Section Two ---------- 22
- Self Check for Capsule Three ---------- 23
- Post-test ---------- 24
- Bibliography ---------- 26

Appendix
- Pre-test ---------- 28
- Worksheet #3-17 ---------- 30
- Worksheet #3-19 ---------- 31
- Worksheet #3-20 ---------- 32
- Directions for Playing Wipe-out ---------- 33
- Worksheet #3-21 Game Sheet for Wipe-out ---------- 34
- Self Check-Section One ---------- 35
- Worksheet #3-22 ---------- 36
- Worksheet #3-23 ---------- 37
- Worksheet #3-24 ---------- 38
- Self Check-Section Two ---------- 39
- Self Check for Capsule 3 ---------- 40
- Post-test ---------- 41

PACKAGE RESUME FORM

BASIC METRICS

PUBLICATION DATE: May, 1979

LEVEL/SUBJECT: Jr. - Sr. High

TITLE: Basic Metrics

AUTHOR: Joan Noyes

ABSTRACT:

Basic Metrics is a capsule on the basics of the metric system. The capsule investigates the advantages of the metric system, as well as, how to measure lengths in metrics. The activities include many actual measuring tasks. Prerequisite skills include: the ability to work problems using basic arithmetic operations and some ability to measure objects with a ruler or tape. Basic Metrics is a three part series which can be used in many content areas.

Basic Metrics--Part 2 continues with learning how to change the value of different prefixes, how to measure in area and volume/capacity in metrics. As in Part 1, the student will be doing many real measuring tasks. Before the student begins Part 2, he/she must successfully complete Part 1.

Basic Metrics --Part 3 continues with learning how to measure mass and temperatures in metrics and in tying all three capsules together.

Each capsule will take from 4-6 hours to complete. So, for all three capsules, the completion time is 12- 18 hours.

OBJECTIVES

Upon completion of this capsule your students will be able to:

identify metric terms and symbols used in measuring mass and temperature.

apply metric principles to solve problems in measuring mass and temperature.

MATERIALS LIST

Teacher

mat board
wide transparent tape
poster board
construction paper
vinyl stick letters
file folders
basket for finished papers
editorial from newspaper
1 wooden centimeter ruler
3 tables/ desks
discarded greeting cards/ fabric
index cards
3 Zip Loc Bags
plastic or wooden cube 2cmx2cmx2cm
felt tip markers
large clasp envelope

Student

metric scales and weights
Zip Loc bag containing:
- paper clip
- pencil eraser
- marble
- small rock
- pencil
- thumb tack
- ruler
- scissors
- rubber band

Zip Loc bag containing wet sponge
Zip Loc bag containing dry sponge
small pan
Celsius thermometer
ice water
popcorn
oil
popcorn popper
wipe-out cube
copies of all worksheets
pencil
paper

USING BASIC METRICS CAPSULES AND THE CENTER

This center is designed to be used with three learning capsules, Basic Metrics 1, 2, and 3. The capsules will serve the purpose of task cards, since they will direct the students to appropriate stations in the activities he/she has chosen. The capsules will also be a source of information to the student about metrics.

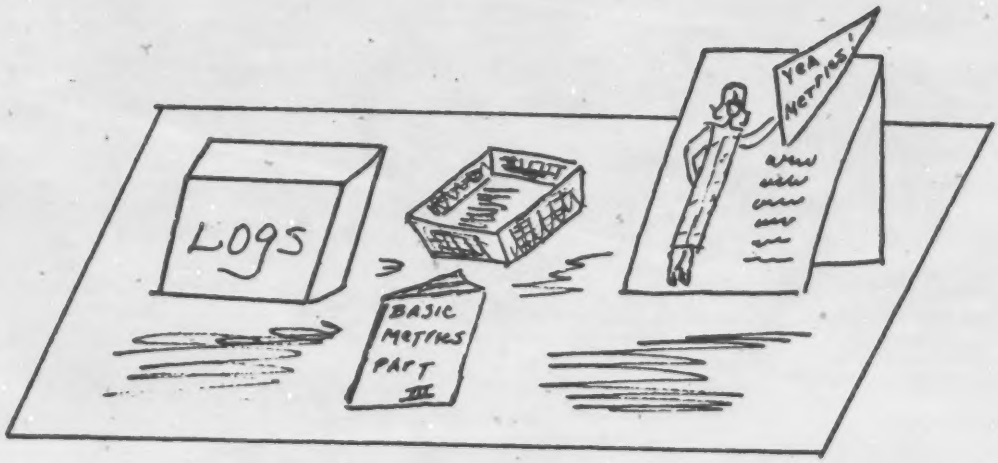
Students should be given a pre-test to determine which capsules in the sequence need to be done. All students will be required to complete Section One of Basic Metrics--Part 1. Since the time required for students to complete the first activity will vary, all students will not be at the same point in the capsule. Since space in some classrooms is limited, activities may take place at the students' desks. However, some activities will need to be completed at one of the satellite stations. You will want to limit the number of stations during a time period. Working time in the center will be 45 minutes per day for two or three weeks.

Students are directed by the capsule which they are using to complete activities. Directions are given in the capsule which tell them how to do the activity, where to go for materials and what to do with their work when they are finished.

The various stations of the center are spread out in the classroom to allow for flow of traffic and noise. A description of each station may be found on the following pages.

MANAGEMENT STATION

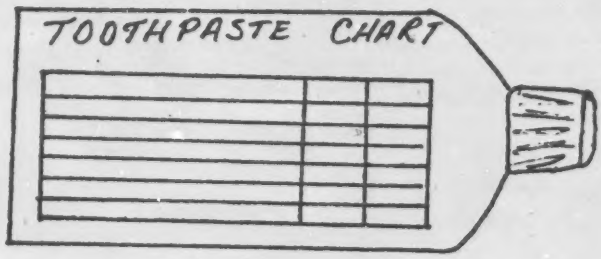
The Management Station consists of posters, a file for individual student logs, copies of the capsules Basic Metrics 1, 2, & 3, answer keys for activities, and a basket for completed work. A table top is used to display these items as shown below.



The Management Station

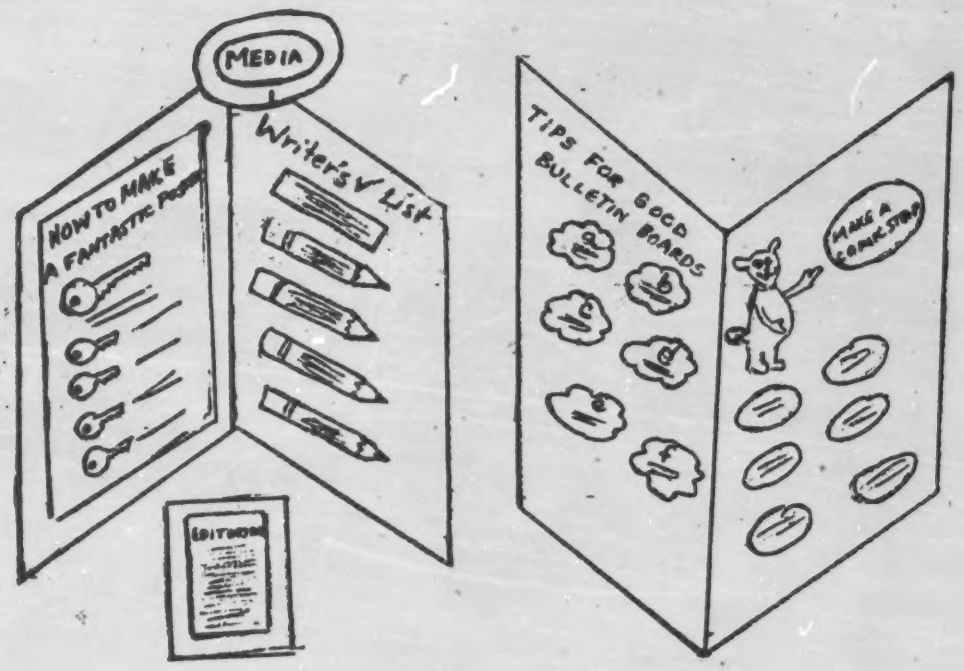
MEASURING STATION

The Measuring Station contains a box of assorted bottles, boxes, cans, popcorn, paper clips, etc. to be used for measurement activities. There is also a box for worksheets and games which go with the activities in this station. The station will contain rulers, scales, meter sticks, metric measuring cups and spoons for the various activities and the two charts described on the following page.



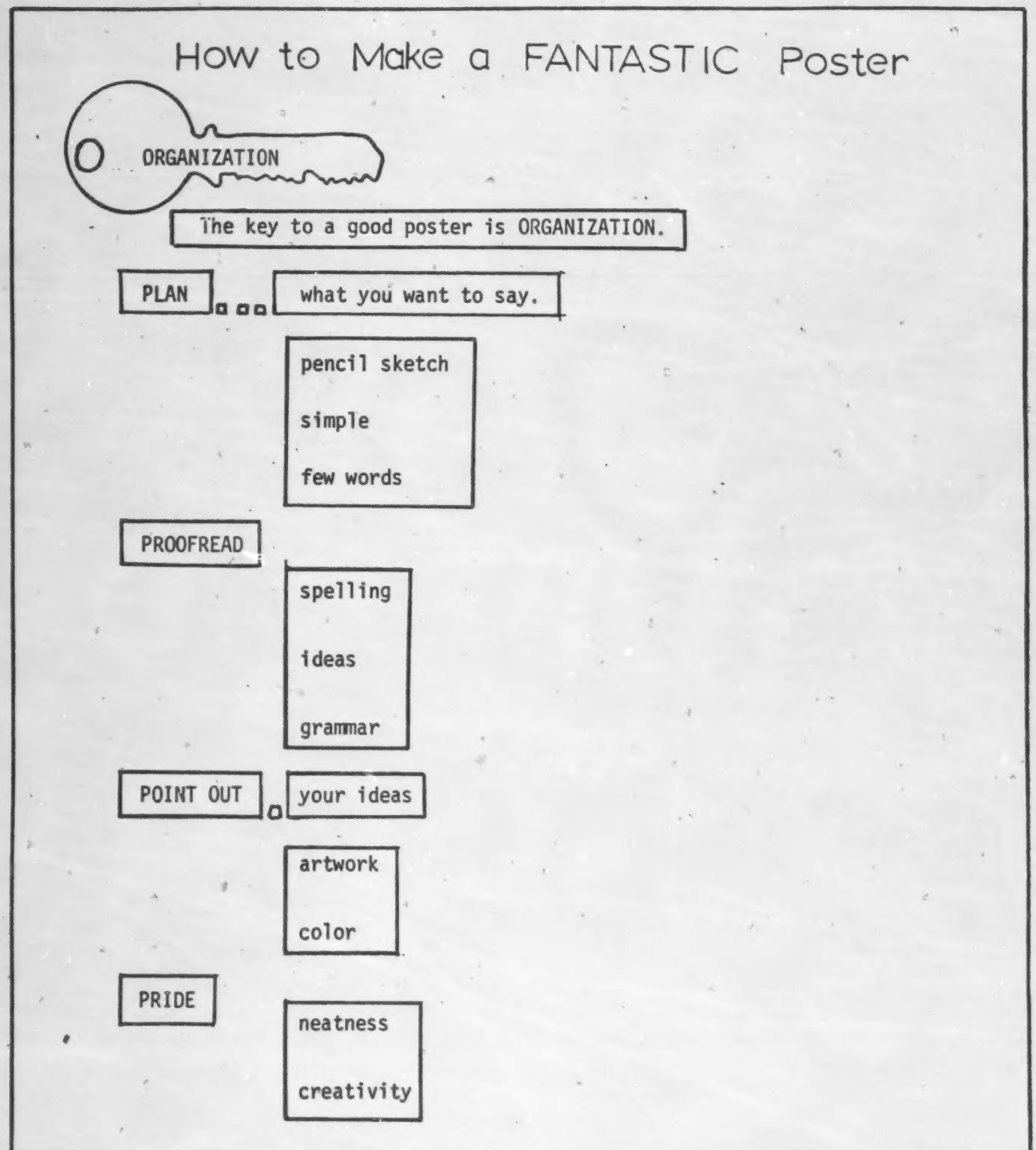
MEDIA STATION

This station is designed to be used as a teaching tool for students. It is constructed from mat board which has been hinged together with wide tape. Each section contains information needed by students to complete writing or display activities. Detailed descriptions of each section are given on the following pages.



How to Make a Fantastic Poster

This section of the Media Station is actually a poster which tells the student how to make a poster.



BEST COPY AVAILABLE

Writer's ✓ List

The Writer's ✓ List helps students proofread their work for errors. You may wish to have your students proofread their own work, or you may wish to use a buddy system for proofreading. Use construction paper and cut out the pencils. Mount the pencils and directions on the mat board. If the mat board and the pieces to be mounted are laminated first and put up with tape, the mat board may be reused for other centers.

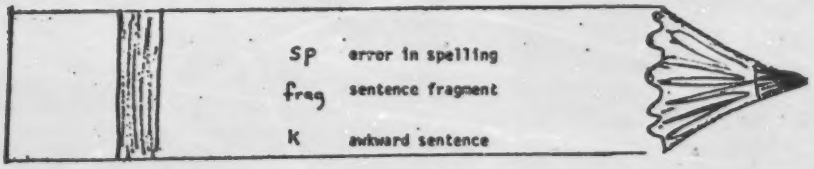
Have a classmate proof-read your paper for errors.

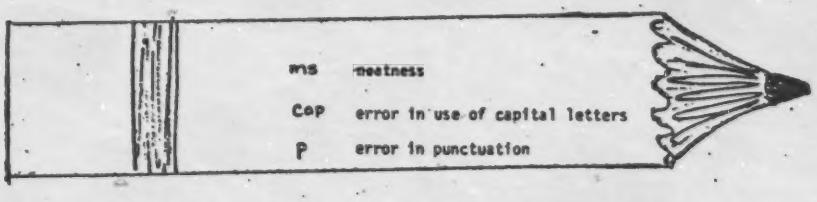
The proofreader will use the code below to mark each line in which there is an error.

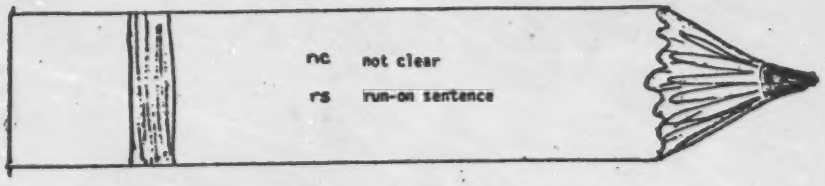
The proofreader will write the code letters in the left margin.

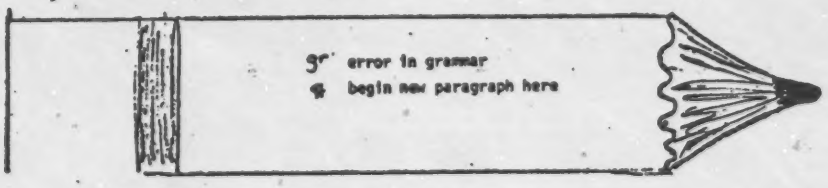
After the lines with errors have been marked, find each mistake and correct it.

Copy your writing over before handing it in or displaying it.









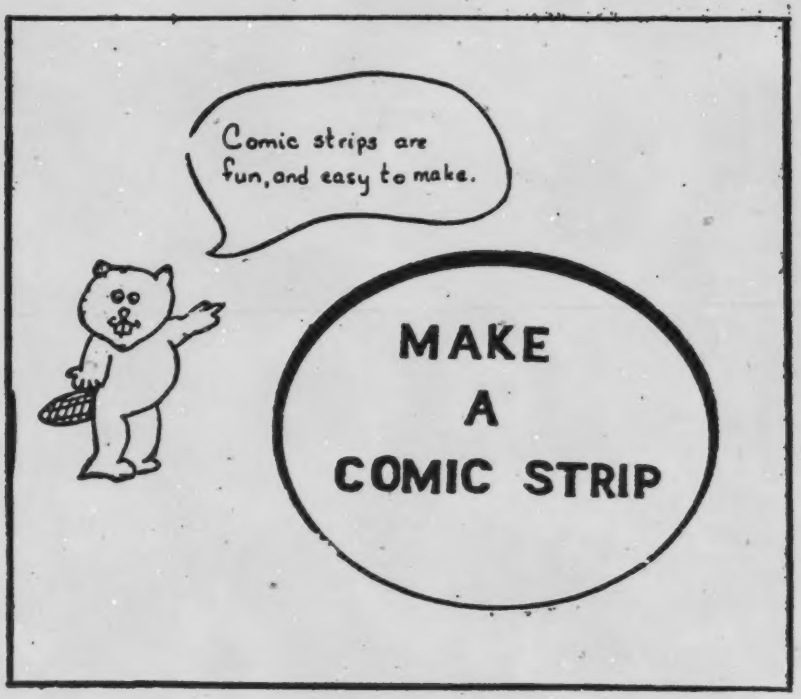
TIPS FOR GOOD BULLETIN BOARDS

The following tips may be typed on index cards and mounted on swatches of fabric or the fronts of discarded greeting cards. Use a piece of burlap and plastic stick-on letters to make the title strip for this section of the Media Station.

Tips for Good Bulletin Boards
a Bulletin boards take planning.
b Decide the ideas you want to show with your bulletin board.
c Bulletin boards are better if they are simple and neat.
d Use color and artwork to help "sell" your idea.
e Letters should be large enough to be seen from a difference.
f Proofread your board for errors.

MAKE A COMIC STRIP

Make a larger copy of the title poster. This may be laminated to protect it. Type the information below onto index cards or small circles. The cards or circles may be mounted on contrasting paper to make them stand out.



1- Plan your story before you begin drawing your cartoon.

2 Use the cartooning sheet that your teacher has provided at this station.

3 Sketch your cartoon in the comic strip squares.

4 Proofread your comic strip. Use the Writer's ✓ List.

5 Use line-line felt tip pens or colored pencils to go over your sketches.

NOTES FOR THE TEACHER

Section 1:

Mass is the topic for this section. Mass is the amount of material an object contains. To measure mass you will need a set of scales and metric weights. The students will need to learn how to use the scales so you will also need to familiarize yourself with the scales so that you can teach the students how.

Activity 17 You may wish to put all of the items to be weighed together in a Zip Loc bag. This will help students keep these materials together. A copy of the worksheet is included in the appendix of this guide.

Activity 19 This activity will require popcorn, oil, and a popper or a pan and stove. The student needs to be sure to weigh the popped corn before eating any of it, so that he/she can get an accurate reading. A copy of the worksheet is included in the appendix.

Activity 20 This activity involves decoding a message. It could be modified to use any of the metric units. You might also want students to make up their own message to decode and give to another student to solve. A copy of this worksheet is included in the appendix.

Activity 21 This activity is the game Wipe-out. You will need a cube with metric measurements on it. You could use the numbers listed below, or you could have several different cubes available for the student to choose from when playing the game. You will also need copies of the game sheet for each student playing the game. The numbers used on the cube are 50 g, 0.2 kg, 0.15 kg, 100 g, 25 g, and Wipe-out. All materials should be kept in a clasp envelope at the Measuring Station. The directions for playing the game and a copy of the worksheet are found in the appendix to this guide.

Section 2:

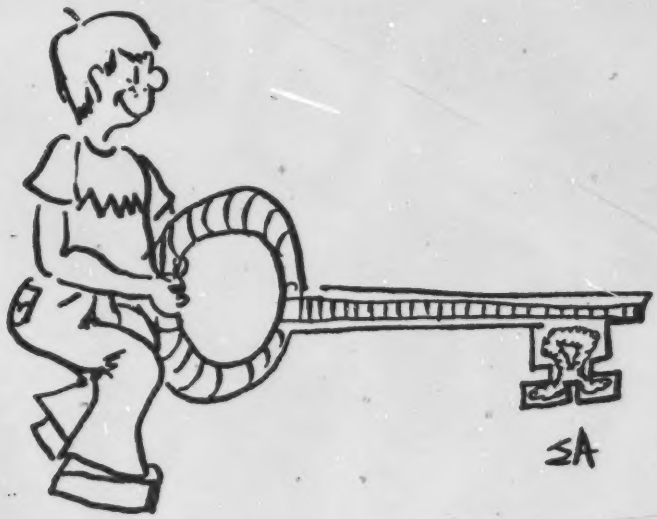
Temperature is looked at in Section 2. The student will be measuring and recording temperatures in Celsius. You will need a Celsius thermometer for students to use. The student will also learn how to convert from Celsius to Farenheit and from Farenheit to Celsius.

Activity 22 This activity will need to be completed at home, or with the permission of school cooks, in the school kitchen.

Activity 24 In order to complete this activity students need to know how to make a graph. Students who have not had much experience with graphs may need extra help on this activity.

Section 3:

This section is a review of Basic Metrics Parts 1, 2 and 3.



Keys to all worksheets are included on the following pages.

BASIC METRICS: PART 3

Pre-test

Name Key Date _____

Choose the correct answer and write it on the line to the left of the question.

a 1. The abbreviation for grams is

a. g
b. G
c. gr
d. gm

a 2. Gram is the unit used for

a. measuring the weight an object has.
b. determining the calories that are contained in a substance.
c. measuring the pounds of weight an object has.
d. a unit for measuring temperature.

c 3. 1 kg equals ____ grams.

a. 100
b. 10
c. 1000
d. .001

b 4. In metrics, temperature is measured in

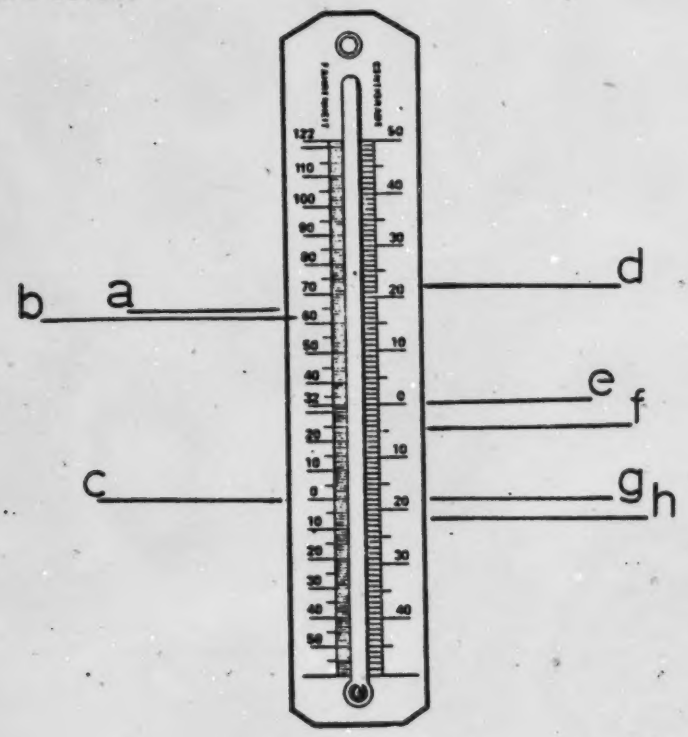
a. ^{o}F
b. ^{o}C
c. ^{o}T
d. ^{o}G

5. Using the following formula, $^{o}F - 32 \times 5/9 = {}^{o}C$, what would $78^{o}F$ be in ^{o}C?

25°C or 26°C

Basic Metrics: Part 3 Pre-test (Cont.)

Below is a drawing of a thermometer. Match the letters beside the thermometer with the correct temperature. Write the letter on the line beside the correct temperature below.



6. e 0°C

7. b 62°F

8. d 22°C

9. f - 5°C

10. a 65°F

Basic Metrics: Part 3
Activity 17
Worksheet #3-17

Name Key Date _____

Complete this worksheet and turn it in to your teacher.

Use the scales and the metric weights to weigh the items listed below. Put the weight on the line below the items. You will find the items to be weighed in a plastic bag at the Measuring Station.

Answers will vary depending on size of item.

1.	paper clip	pencil eraser
	_____	_____
2.	marble	rock
	_____	_____
3.	pencil	thumb tack
	_____	_____
4.	ruler	scissors
	_____	_____
5.	toothpick	rubber band
	_____	_____

List all ten items from heaviest to lightest.

Find two different items that balance each other on the scales when you weigh them. List the items and give the weight.

Basic Metrics: Part 3
Activity 19
Worksheet #3-19

Name key Date _____

Directions: For this activity you will need a scale, mass pieces, popcorn, oil and a popper. Carefully weigh out 40 g of unpopped corn and record the mass in the space below. Pop the corn and record the mass of the popped corn. Is there a difference? Answer the questions below. See if you can find out why there is a difference. After you have eaten the popcorn, turn in your paper.

What is the mass of the unpopped corn? 40g.

What is the mass of the popped corn? answers will vary

Did all the popcorn pop at the same time? no

When you lift the lid of the popcorn popper, you see water vapor.

Where did the water vapor come from? inside the corn

What happens to water molecules when they are heated? They move faster, spread out.

Why did the popcorn pop? The water molecules inside the corn expanded & caused the corn to pop.

Why didn't all of the corn pop at the same time? All of the water wasn't heated evenly/less water in some corn, etc.

Why is the mass of popped corn different from the mass of unpopped corn? Water has escaped, so popcorn weighs less when popped.

Basic Metrics: Part 3

Activity 20

Worksheet #3-20

Name _____ Date _____

Directions: Decode the following message to answer the riddle. To decode the message, work the problems that are numbered 1-6 and put the answer in the line provided. Notice that there is a space for each letter in the answer, and under the space there is a number. Look up the answer for that numbered problem. Then in the column of letters, match the answers and write the corresponding letter in the space. For example, if the answer to the numbered problem is 3.7 kg, then the letter you put in that numbered space is H.

RIDDLE: Round as a biscuit, deep as a cup, all the king's horses can't pull it up. What is it?

A	W	E	L	L
4	6	3	2	2

1. 2.5 g + 3.2 g = 5.7 g — A = 400g
2. 500 mg + 500 mg = 1 g — C = 5.7 g
3. 1.2 kg + 800 g = 2000 g — E = 2000 g
4. 300 g + 0.1 kg = 400 g — H = 3.7 kg
5. 2000 g + 1.7 kg = 3.7 kg — L = 1 g
6. 1250 g + 3.72 kg = 4.97 kg — W = 4.97 kg

Basic Metrics: Part 3

Self Check: Section One

Name key Date _____

Directions: Unscramble the letters to find a word that has to do with measuring mass. After you have unscrambled a word, write the definition behind it.

1. agmr gram - unit for measuring weight

2. mssa mass - amount of material an object contains

3. lgakmiro kilogram - 1000 grams

4. llraiigmm milligram - .001 gram

5. elssca scales - equipment used for weighing

6. labaean balance - equal weight on both sides

When you have finished this self-check, get the key from your teacher and check your work. Then turn your paper and the key in to your teacher.

Basic Metrics: Part 3
Activity 22
Worksheet #3-22

Name key Date _____

Complete this worksheet by measuring and recording the temperatures of the following items.

Freezer temperature	0 °C	32 °F
Refrigerator temperature	_____ °C	_____ °F
Room temperature	20 °C	68 °F
Ice water	_____ °C	_____ °F
Tap water	_____ °C	_____ °F
Hot liquid	100 °C	212 °F

Answers may vary.

Basic Metrics: Part 3

Activity 23

Worksheet #3-23

Name key Date _____

Complete this worksheet. When you are finished, turn your paper in to your teacher. Using the formulas given, change the following temperatures as instructed. Show your work.

Use the following formulas:

From ^{o}F to ^{o}C: subtract 32 from ^{o}F, then multiply by 5/9

From ^{o}C to ^{o}F: multiply ^{o}C by 9/5, then add 32

Change $68^{o}F$ to ^{o}C

20°C

Change $88^{o}C$ to ^{o}F

190°F or 191°F

Change $34^{o}F$ to ^{o}C

1°C or 2°C

Change $75^{o}C$ to ^{o}F

167°F or 168°F

Change $118^{o}F$ to ^{o}C

47°C or 48°C

Change $34^{o}C$ to ^{o}F

93°F or 94°F

Change $88^{o}F$ to ^{o}C

31°C or 32°C

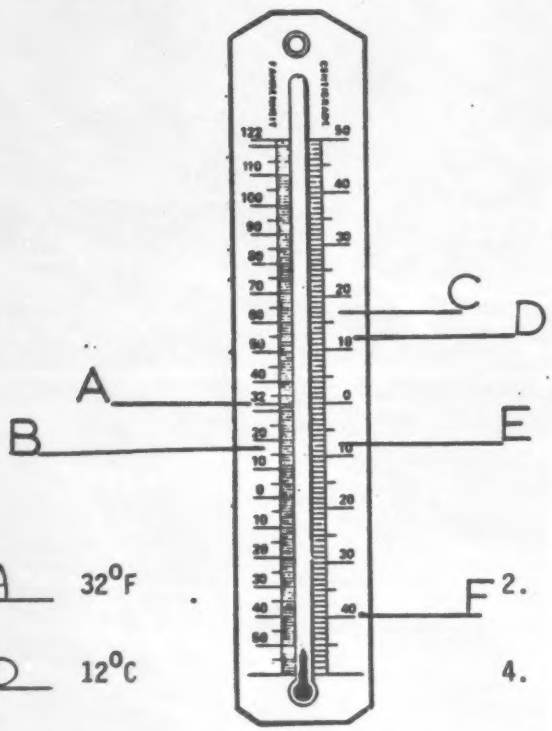
Change $118^{o}C$ to ^{o}F

244°F or 245°F

Basic Metrics: Part 3
Self Check--Section 2

Name key Date _____

Below is a drawing of a thermometer. You will find some letters and lines connected to the drawing. Match the letter with the correct temperature. Write the letter on the line beside the correct temperature below.



1. A 32°F

2. F -40°C

3. D 12°C

4. C 17°C

Work the following problems. Show your work.

5. Change 77°F to °C.

25°C

6. Change 30°C to °F.

86°F

23

Basic Metrics: Part 3
Self Check for Capsule 3

Name _____ **Date** _____

ACROSS

1. The abbreviation m stands for _____.
5. Water freezes at _____°C.
6. The unit to use in measuring area is _____.
8. The abbreviation for the International System of Units is _____.
11. The space that a container occupies is its _____.
12. The abbreviation for millimeter is _____.
17. You would use a thermometer to measure _____.
19. When you know how long an item is, you know its _____.
22. A _____ is almost a quart.
23. This prefix means "times 1000".
24. This prefix means "x 10".
25. The weight of an object is its _____.
27. Kilo means "x _____".
28. Area = length x _____.

DOWN

1. The abbreviation mm stands for _____.
2. Metrics is based on a base _____ SYSTEM.
3. Length x width x depth = _____.
4. Metrics is a _____ language.
7. length x width = _____.
9. The abbreviation for milliliter is _____.
10. Water boils at _____°C.
13. The universal language of measurement is called _____.
14. In order of size, what is missing? deci, _____, milli

1 M	E	2 T	E	R	■	3 C	■	■	■	■	■	4 V	■	5 O	■	■	■
I	■	E	■	6 S	Q	U	A	R	E	■	■	N	■	■	■	■	7 A
L	■	N	■	■	■	B	■	■	■	■	8 S	I	■	9 M	■	■	R
L	■	■	10 I	■	■	I	■	■	■	■	■	11 V	O	L	U	M	E
I	■	■	O	■	■	C	■	12 M	13 M	■	■	E	■	■	■	■	A
M	■	■	O	■	■	■	■	■	E	■	■	R	■	■	■	14 C	■
E	■	15 K	■	16 C	■	■	■	■	T	■	■	S	■	■	■	E	■
17 T	E	M	P	E	R	A	T	U	R	E	■	A	■	■	18 K	N	■
E	■	■	■	L	■	■	■	■	I	■	■	19 L	E	N	G	T	H
R	20 S	■	■	S	■	■	21 C	■	C	■	■	■	■	■	■	I	■
■	C	■	22 L	I	T	E	R	■	■	23 K	I	L	O	■	■	■	■
■	A	■	■	U	■	■	A	■	■	■	■	■	■	24 D	E	C	A
■	L	■	■	S	■	■	25 M	A	S	S	■	26 I	■	E	■	■	■
■	E	■	■	■	■	■	■	■	■	■	■	O	■	C	■	■	■
■	S	■	27 I	O	O	O	■	■	■	■	■	■	28 W	I	D	T	H

15. The abbreviation for kilometer is _____.
16. Temperature is measured metrically in °_____.
18. The abbreviation for kilogram is _____.
20. You measure weight on _____.
21. The unit when measuring weight is _____.
24. This prefix means ÷ by 10.
16. Deca means "x _____".

BASIC METRICS: PART 3
Post-test

Name _____ Date _____

Match the abbreviation to its word. Write the letter of your answer in the space provided.

e	1. meter	a. g
a	2. gram	b. ^{o}C
h	3 hectogram	c. l
c	4. liter	d. kg
k	5. centimeter	e. m
f	6. cubic milliliter	f. ml^3
j	7. decameter	g. mm
b	8. degrees Celsius	h. hg
g	9. millimeter	i. mg
d	10. kilogram	j. dam
		k. cm
		l. ml^2

Show your work and solve the following problems.

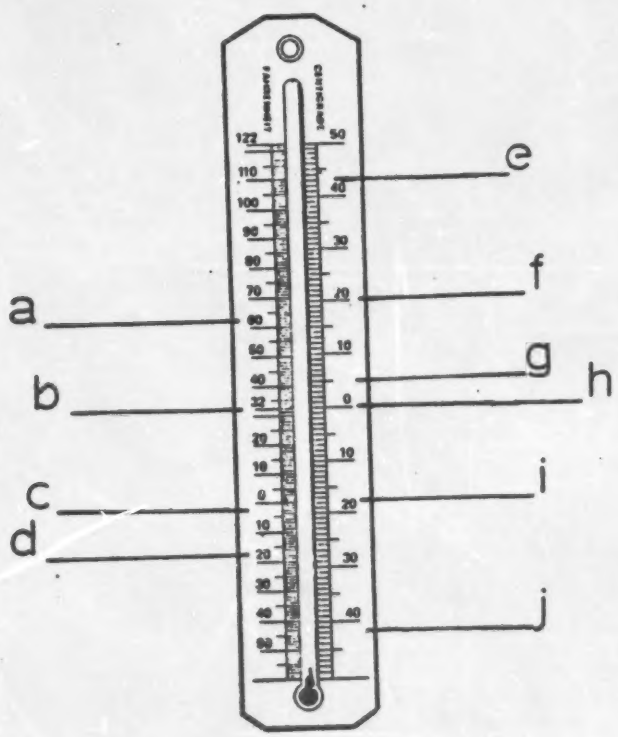
11. Using the following formula, $^{o}F - 32 \times 5/9 = {}^{o}C$, what would $100^{o}F$ be in ^{o}C?

37°C or 38°C

12. Using the following formula, $9/5 \times {}^{o}C + 32 = {}^{o}F$, what would $82^{o}C$ be in ^{o}F? 179° F or 180° F

Basic Metric: Part 3 Post-test (cont.)

Below is a drawing of a thermometer. Match the letters beside the thermometer to the correct temperatures. Write the letter on the line beside the temperature below.



13. b 32°F
14. e 43°C
15. i - 18°C
16. c - 3°F
17. f 20°C
18. a 62°F
19. b 0°C
20. j -42°C

BIBLIOGRAPHY

Books

1. Bowles, Richard D.; Make Way for Metrication; Lerner Publication Co.; Minneapolis, Minnesota; 1975.

2. Kelly, Gerald W.; The Metric System Simplified; Sterling Publishing Co. Inc.; New York; 1976.

3. Ross, Frank Jr.; The Metric System; S. G. Phillips--Publisher; New York; 1974.

4. Young, Lorelle and Carole Bielefeld; Hometrics; Editor--Patricia M. Horton; Publisher--Enrich, Inc.; 1977.

Phamplets

1. "Going Metrics" John E. Roller, Director
   Educational Service Center
   Box 45308
   Tulsa, OK 74145

2. "Metrics" Elinor Anderson and Mildred Walker
   Cooperative Extension Service
   Kansas State University
   Manhattan, KS

3. "Teaching Metrication" Sears Roebuck and Co.
   Consumer Information Services-D/703
   Sears Tower
   Chicago, IL 60684

Films

1. "A Metric America" Aims Films Media Services, Inc.
   626 Justin Avenue
   Glendale, California 91201

   16 mm for jr.-sr. high Time- 16 minutes

   Conversion, saving of time and effort, conversion of money, a share of international market place.

2. "Metric Measurement II" Journal Films
   909 West Diversey Parkway
   Chicago, IL 60614

   16 mm for jr. high Time- 15 minutes
   Measuring, comparison, and base 10.

APPENDIX

This appendix contains copies of all worksheets and assessments. These copies may be used to make your own classroom quantity copies. To use, unstaple the sides of the teacher's guide and remove the worksheet and assessment pages. Restaple the remaining pages of the teacher's guide.

BASIC METRICS: PART 3

Pre-test

Name _____ Date _____

Choose the correct answer and write it on the line to the left of the question.

_____ 1. The abbreviation for grams is

a. g
b. G
c. gr
d. gm

_____ 2. Gram is the unit used for

a. measuring the weight an object has.
b. determining the calories that are contained in a substance.
c. measuring the pounds of weight an object has.
d. a unit for measuring temperature.

_____ 3. 1 kg equals _____ grams.

a. 100
b. 10
c. 1000
d. .001

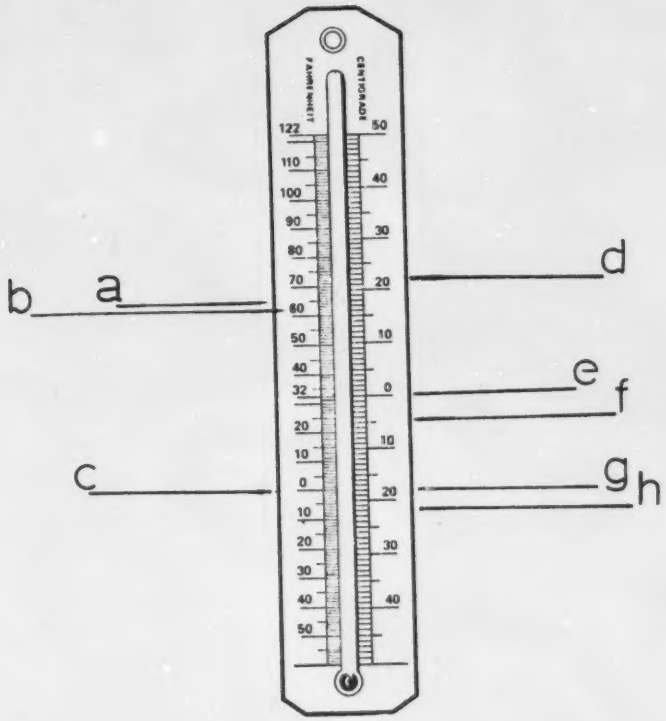
_____ 4. In metrics, temperature is measured in

a. ^{o}F
b. ^{o}C
c. ^{o}T
d. ^{o}G

5. Using the following formula, $^{o}F - 32 \times 5/9 = {}^{o}C$, what would $78^{o}F$ be in ^{o}C?

Basic Metrics: Part 3 Pre-test (Cont.)

Below is a drawing of a thermometer. Match the letters beside the thermometer with the correct temperature. Write the letter on the line beside the correct temperature below.



6. _____ $0^{o}C$

7. _____ $62^{o}F$

8. _____ $22^{o}C$

9. _____ $-\ 5^{o}C$

10. _____ $65^{o}F$

Basic Metrics: Part 3
Activity 17
Worksheet #3-17

Name _____ Date _____

Complete this worksheet and turn it in to your teacher.

Use the scales and the metric weights to weigh the items listed below. Put the weight on the line below the items. You will find the items to be weighed in a plastic bag at the Measuring Station.

1.	paper clip	pencil eraser
	_____	_____
2.	marble	rock
	_____	_____
3.	pencil	thumb tack
	_____	_____
4.	ruler	scissors
	_____	_____
5.	toothpick	rubber band
	_____	_____

List all ten items from heaviest to lightest.

Find two different items that balance each other on the scales when you weigh them. List the items and give the weight.

Basic Metrics: Part 3

Activity 19

Worksheet #3-19

Name _____ Date _____

Directions: For this activity you will need a scale, mass pieces, popcorn, oil and a popper. Carefully weigh out 40 g of unpopped corn and record the mass in the space below. Pop the corn and record the mass of the popped corn. Is there a difference? Answer the questions below. See if you can find out why there is a difference. After you have eaten the popcorn, turn in your paper.

What is the mass of the unpopped corn? _____

What is the mass of the popped corn? _____

Did all the popcorn pop at the same time? _____

When you lift the lid of the popcorn popper, you see water vapor.

Where did the water vapor come from? _____

What happens to water molecules when they are heated? _____

_____

Why did the popcorn pop? _____

_____

Why didn't all of the corn pop at the same time? _____

_____

Why is the mass of popped corn different from the mass of unpopped corn?

_____

_____

Basic Metrics: Part 3

Activity 20

Worksheet #3-20

Name _____ Date _____

Directions: Decode the following message to answer the riddle. To decode the message, work the problems that are numbered 1-6 and put the answer in the line provided. Notice that there is a space for each letter in the answer, and under the space there is a number. Look up the answer for that numbered problem. Then in the column of letters, match the answers and write the corresponding letter in the space. For example, if the answer to the numbered problem is 3.7 kg, then the letter you put in that numbered space is H.

RIDDLE: Round as a biscuit, deep as a cup, all the king's horses can't pull it up. What is it?

____	____	____	____	____
4	6	3	2	2

1. 2.5 g + 3.2 g = _____g — A = 400g
2. 500 mg + 500 mg = _____g — C = 5.7 g
3. 1.2 kg + 800 g = _____g — E = 2000 g
4. 300 g + 0.1 kg = _____g — H = 3.7 kg
5. 2000 g + 1.7 kg = _____kg — L = 1 g
6. 1250 g + 3.72 kg = _____ kg — W = 4.97 kg

Basic Metrics: Part 3
Activity 21

DIRECTIONS FOR PLAYING WIPE-OUT

To play this game you will need: a game sheet, a pencil and a game cube. Everything except the pencil is inside this envelope.

Player #1 throws the cube and records the number shown on the cube on the game sheet on the line beside #1. He must decide whether to play again or to quit. If he plays, he records the number he rolls on the die beside #2. Again he must decide whether to play or quit. If he decides to play and gets "Wipe-out" on the die, he loses all of the numbers under his last sub-total. When he decides to quit, he sub-totals the score by adding up the metric units. Then the next player's turn begins. The player with the highest score at the end of ten rounds is the winner.

*** Note to teacher: Cut the directions from the top of this page. Glue the directions to the outside of a clasp envelope. Place the Wipe-out cube and the game sheets inside the envelope.

Basic Metrics: Part 3
Activity 21
Worksheet #3-21

Name _____

GAME SHEET FOR WIPE-OUT

	GAME 1	GAME 2	GAME 3	GAME 4
1.	_____ subtotal	_____ subtotal	_____ subtotal	_____ subtotal
2.	_____ subtotal	_____ subtotal	_____ subtotal	_____ subtotal
3.	_____ subtotal	_____ subtotal	_____ subtotal	_____ subtotal
4.	_____ subtotal	_____ subtotal	_____ subtotal	_____ subtotal
5.	_____ subtotal	_____ subtotal	_____ subtotal	_____ subtotal
6.	_____ subtotal	_____ subtotal	_____ subtotal	_____ subtotal
7.	_____ subtotal	_____ subtotal	_____ subtotal	_____ subtotal
8.	_____ subtotal	_____ subtotal	_____ subtotal	_____ subtotal
9.	_____ subtotal	_____ subtotal	_____ subtotal	_____ subtotal
10.	_____ subtotal	_____ subtotal	_____ subtotal	_____ subtotal

GAME 1: _____

GAME 2: _____

GAME 3: _____

GAME 4: _____

TOTAL _____

Basic Metrics: Part 3
Self Check: Section One

Name _____ Date _____

Directions: Unscramble the letters to find a word that has to do with measuring mass. After you have unscrambled a word, write the definition behind it.

1. agmr _____

2. mssa _____

3. lgakmiro _____

4. llraiigmm _____

5. elssca _____

6. labaean _____

When you have finished this self-check, get the key from your teacher and check your work. Then turn your paper and the key in to your teacher.

Basic Metrics: Part 3
Activity 22
Worksheet #3-22

Name _____ Date _____

Complete this worksheet by measuring and recording the temperatures of the following items.

Freezer temperature	_____ ^{o}C	_____ ^{o}F
Refrigerator temperature	_____ ^{o}C	_____ ^{o}F
Room temperature	_____ ^{o}C	_____ ^{o}F
Ice water	_____ ^{o}C	_____ ^{o}F
Tap water	_____ ^{o}C	_____ ^{o}F
Hot liquid	_____ ^{o}C	_____ ^{o}F

Basic Metrics: Part 3

Activity 23

Worksheet #3-23

Name _____ Date _____

Complete this worksheet. When you are finished, turn your paper in to your teacher. Using the formulas given, change the following temperatures as instructed. Show your work.

Use the following formulas:

From ^{o}F to ^{o}C: subtract 32 from ^{o}F, then multiply by 5/9

From ^{o}C to ^{o}F: multiply ^{o}C by 9/5, then add 32

Change $68^{o}F$ to ^{o}C

Change $88^{o}C$ to ^{o}F

Change $34^{o}F$ to ^{o}C

Change $75^{o}C$ to ^{o}F

Change $118^{o}F$ to ^{o}C

Change $34^{o}C$ to ^{o}F

Change $88^{o}F$ to ^{o}C

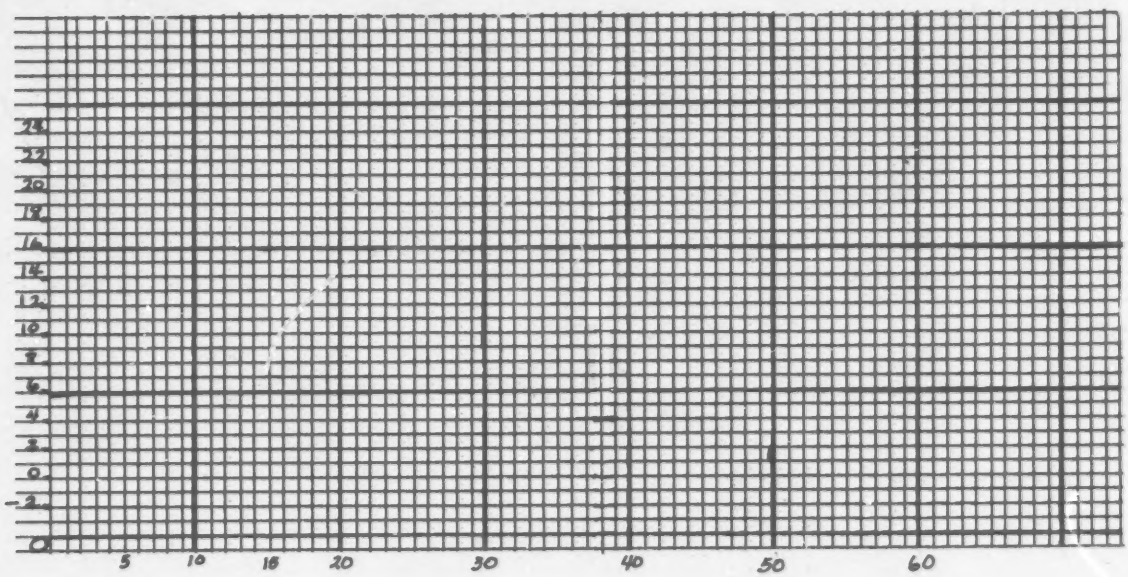
Change $118^{o}C$ to ^{o}F

Basic Metrics: Part 3
Activity 24
Worksheet #3-24

Name _____ Date _____

Use this chart to record the temperatures for Activity 24. Follow the directions in your capsule to complete the activity.

^{o}C

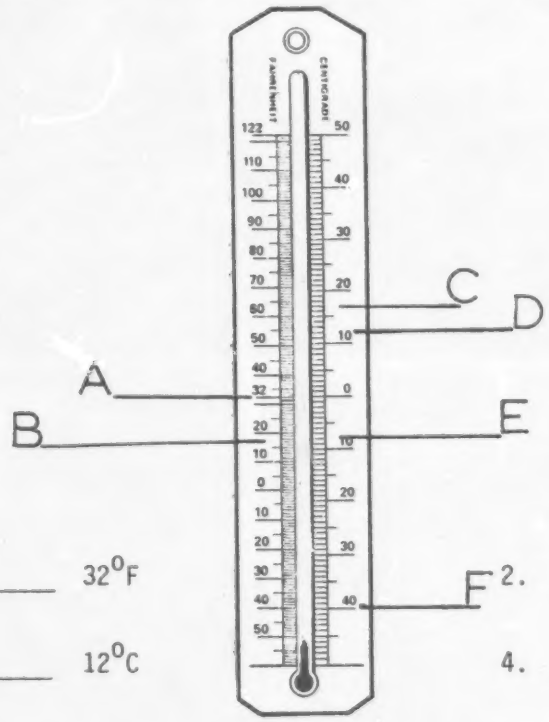


time in minutes

Basic Metrics: Part 3
Self Check--Section 2

Name _____ Date _____

Below is a drawing of a thermometer. You will find some letters and lines connected to the drawing. Match the letter with the correct temperature. Write the letter on the line beside the correct temperature below.



1. _____ $32^{o}F$

2. _____ $-40^{o}C$

3. _____ $12^{o}C$

4. _____ $17^{o}C$

Work the following problems. Show your work.

5. Change $77^{o}F$ to ^{o}C.

6. Change $30^{o}C$ to ^{o}F.

Basic Metrics: Part 3
Self Check for Capsule 3

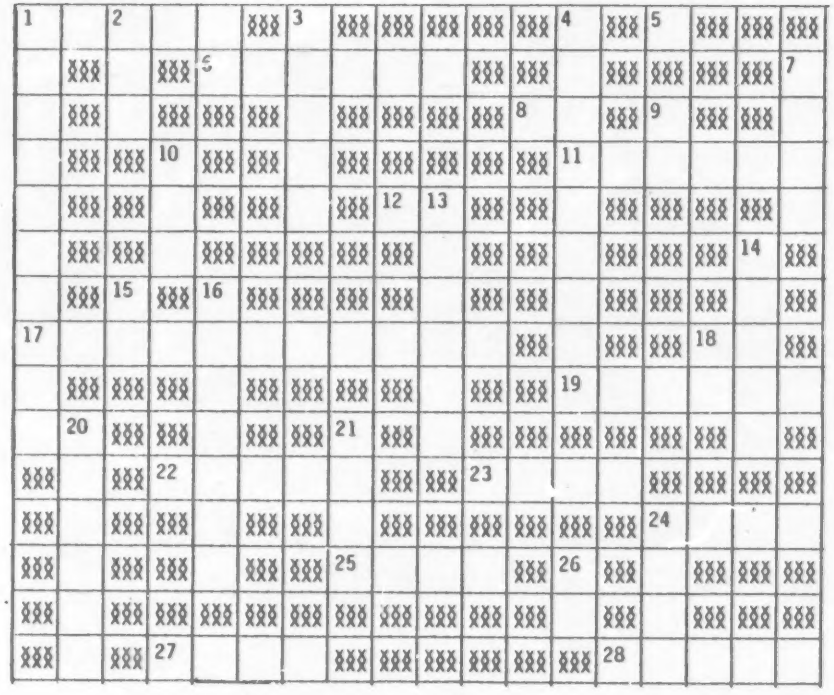
Name _____ Date _____

ACROSS

1. The abbreviation m stands for _____.
5. Water freezes at _____°C.
6. The unit to use in measuring area is _____.
8. The abbreviation for the International System of Units is _____.
11. The space that a container occupies is its _____.
12. The abbreviation for millimeter is _____.
17. You would use a thermometer to measure _____.
19. When you know how long an item is, you know its _____.
22. A _____ is almost a quart.
23. This prefix means "times 1000".
24. This prefix means "x 10".
25. The weight of an object is its _____.
27. Kilo means "x _____".
28. Area = length x _____.

DOWN

1. The abbreviation mm stands for _____.
2. Metrics is based on a base _____ SYSTEM.
3. Length x width x depth = _____.
4. Metrics is a _____ language.
7. length x width = _____.
9. The abbreviation for milliliter is _____.
10. Water boils at _____°C.
13. The universal language of measurement is called _____.
14. In order of size, what is missing? deci, _____, milli



15. The abbreviation for kilometer is _____.
16. Temperature is measured metrically in °_____.
18. The abbreviation for kilogram is _____.
20. You measure weight on _____.
21. The unit when measuring weight is _____.
24. This prefix means ÷ by 10.
16. Deca means "x _____".

BASIC METRICS: PART 3
Post-test

Name _____ Date _____

Match the abbreviation to its word. Write the letter of your answer in the space provided.

_____	1. meter	a.	g
_____	2. gram	b.	^{o}C
_____	3 hectogram	c.	l
_____	4. liter	d.	kg
_____	5. centimeter	e.	m
_____	6. cubic milliliter	f.	ml^3
_____	7. decameter	g.	mm
_____	8. degrees Celsius	h.	hg
_____	9. millimeter	i.	mg
_____	10. kilogram	j.	dam
		k.	cm
		l.	ml^2

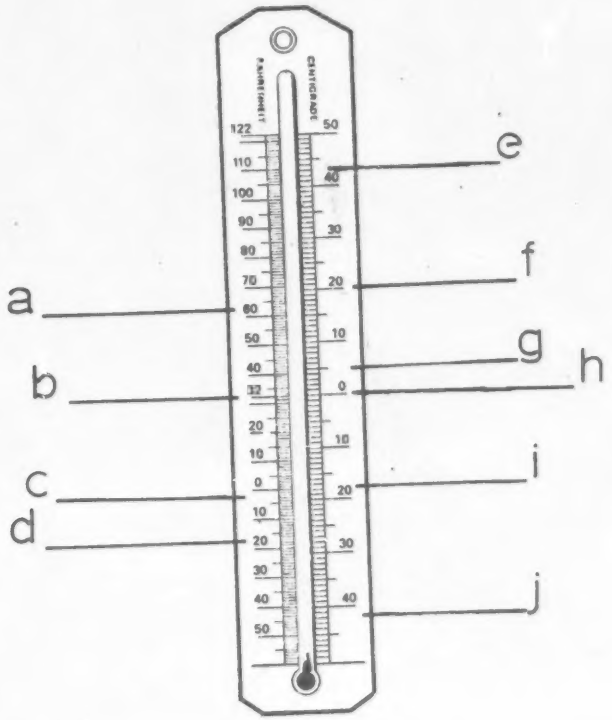
Show your work and solve the following problems.

11. Using the following formula, $^{o}F - 32 \times 5/9 = {}^{o}C$, what would $100^{o}F$ be in ^{o}C?

12. Using the following formula, $9/5 \times {}^{o}C + 32 = {}^{o}F$, what would $82^{o}C$ be in ^{o}F?

Basic Metric: Part 3 Post-test (cont.)

Below is a drawing of a thermometer. Match the letters beside the thermometer to the correct temperatures. Write the letter on the line beside the temperature below.



13. _____ $32^{o}F$

14. _____ $43^{o}C$

15. _____ $-18^{o}C$

16. _____ $-3^{o}F$

17. _____ $20^{o}C$

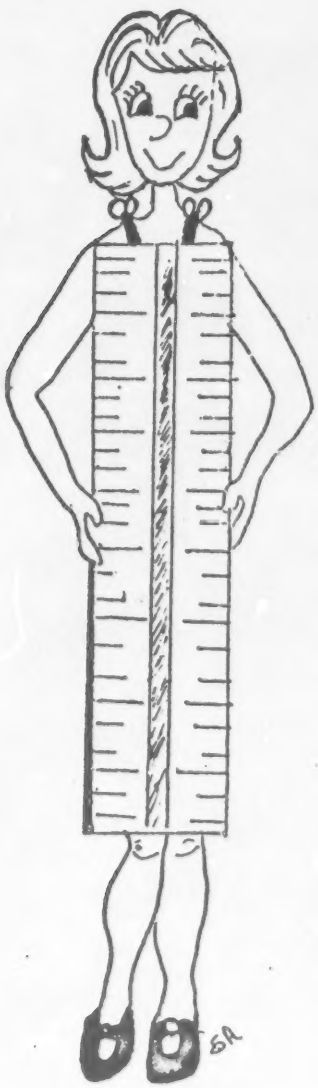
18. _____ $62^{o}F$

19. _____ $0^{o}C$

20. _____ $-42^{o}C$

BASIC METRICS

PART 3



Student Materials

Developed By:
Joan Noyes

As Part of
Project COST
ESEA Title IV
Kansas State Dept. of Education
USD 449
Easton, KS 66020

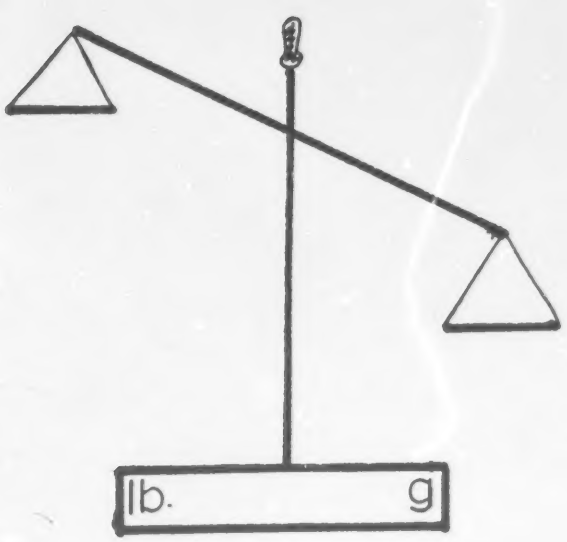
Illustrated by

Sherry Anderson

Before you start Basic Metrics: Part 3, you should have already completed Basic Metrics: Parts 1 and 2. Part 1 was on the advantages of the metric system and on measuring length. Part 2 was on changing prefixes and finding area and volume/capacity.

You are now ready to start Part 3 which looks at measuring mass and temperature in the metric system.

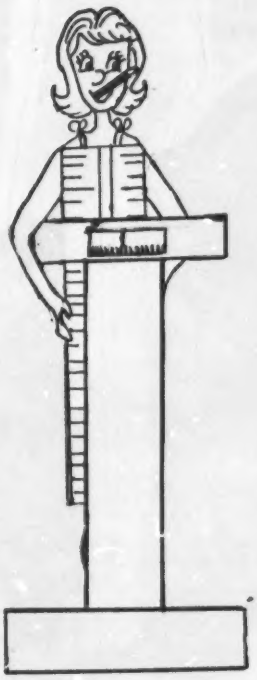
Are you ready to "tip the scale toward metrics?"



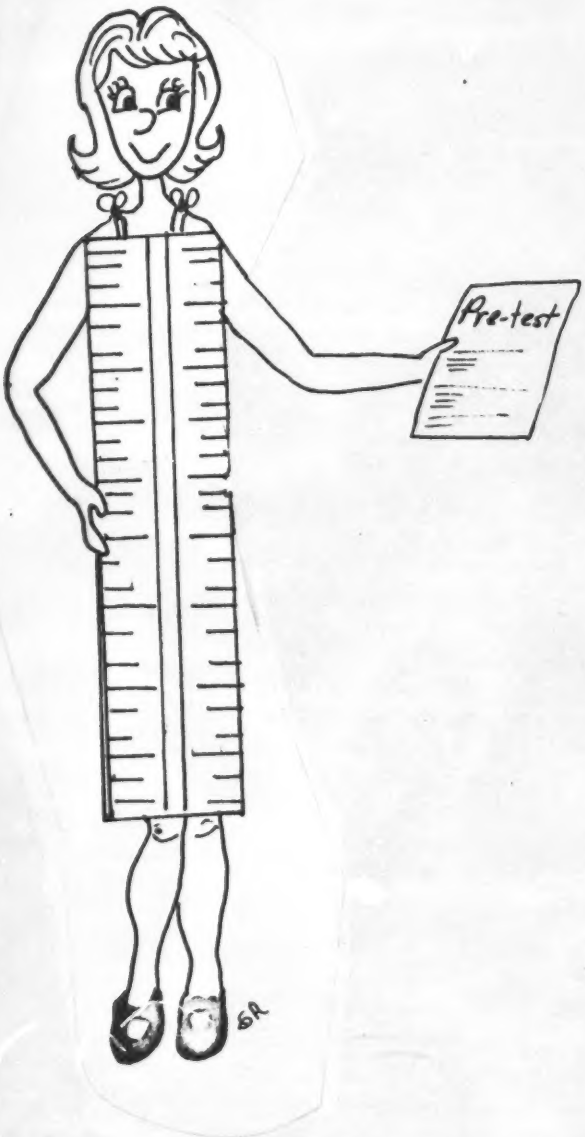
After you have completed this capsule you will be able to:

identify metric terms and symbols used for measuring temperature and mass.

apply metric principles to solve problems involving mass and temperature.

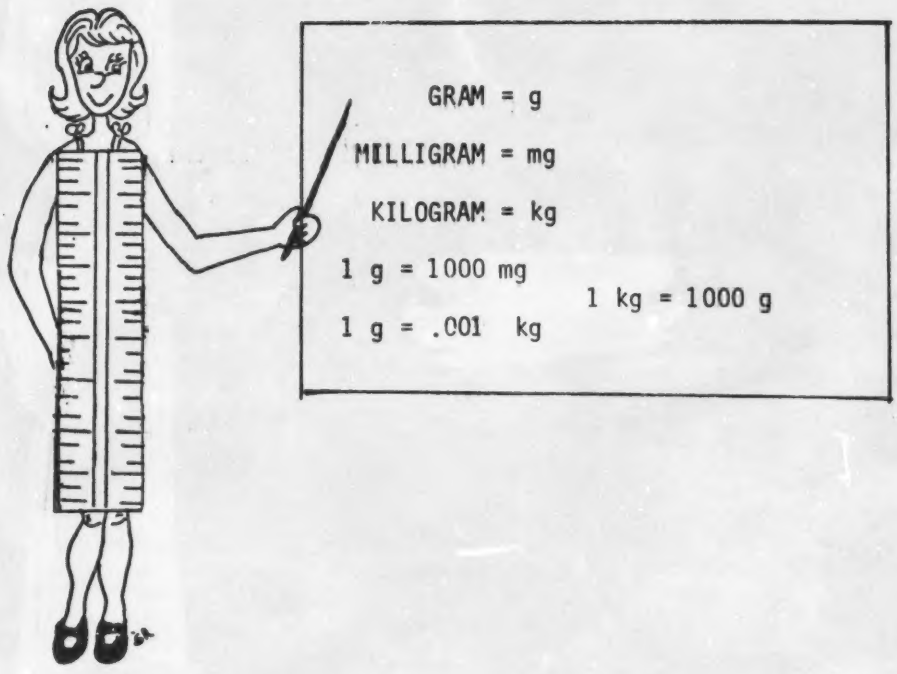


Go to the Metric Center and get the pre-test for Basic Metrics: Part 3. Complete the test and give it to your teacher to check. The pre-test will tell you which sections of the capsule you need to do.



SECTION ONE

MASS



A gram (g) is the unit used for measuring mass or the amount of material an object contains. You would use grams to measure fruits and vegetable, food nutrients in what you eat, and to weigh a letter for mailing.

To make a comparison, a dollar bill has the mass of one gram, while a nickel is five grams in mass.

= 1 gram

= 5 gram

Objects with a large mass are measured in kilograms. One gram is equal to 1000 kilograms. (You will remember that kilo means 1000.) A kilogram is a little more than two pounds (2.2 pounds to be exact). Kilograms would be used to measure such things as flour, sugar, coffee, meat and produce. It is also used for body mass. You will need to remember when you look at the prices for items measured in kilograms that the mass is a little more than two pounds, so the price is a little more than double. For example, if a pound of potatoes cost 49¢, you could expect a kilogram of potatoes to cost something like $1.09.

1 kg = $1.09 1lb. = 49¢

For measuring smaller amounts, you would use milligrams. The abbreviation for milligram is mg. A milligram is a gram divided into one thousand parts, so 1 g = 1000 mg or 1 mg = .001. If you divided a dollar bill into a thousand equal parts, each part would weigh one milligram. Milligrams are used to measure medicines and nutrients in foods.

ACTIVITIES

Do three (3) of the following activities. When you finish an activity turn your paper in to your teacher. Be sure to mark your Record Sheet.

17. In order to complete this activity, you will need the metric scales and weights and the sack of objects from the Measuring Station. The sack is labeled "Activity 17". You will also need Worksheet #3-17 from the Metric Center. Follow the directions on the worksheet.

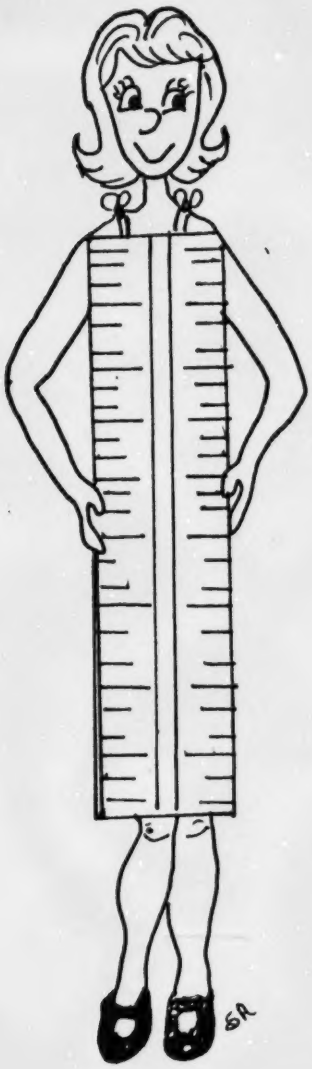
18. From the Measuring Station get the plastic bag labeled, "Activity 18". Inside you will find a wet sponge and a dry sponge. Using the metric scales and weights, find the weight of each. On a sheet of paper record the weight of each sponge. Explain why one sponge weighs more than the other.

19. For this activity you will need metric scales and weights, popcorn (unpopped), oil and a popcorn popper. All of these materials can be found at the Measuring Station. You will also need Worksheet #3-19. which is in the Metric Center. Follow the directions on the worksheet as you complete the activity.

20. Get Worksheet #3-20 from the Metric Center. Answer the riddle by decoding the message. Follow the directions on the worksheet.

21. Choose two or three other students to play Wipe-out. The materials and rules for this game are in a large envelope at the Measuring Station. Be sure to return all materials when you are finished.

When you feel that you understand this section, go to the Metric Center and get Self Check-Section One for this capsule. When you have completed the self check, get the key from your teacher and check your answers. Turn in your paper and the key to your teacher.



SECTION TWO

TEMPERATURE

If you want to take the temperature of something in our conventional method, you measure in degrees Farenheit (^{o}F). When you measure in metrics you use a unit called degrees Celsius (^{o}C).

Water freezes at $32^{o}F$ *** which is $0^{o}C$.

Water boils at $212^{o}F$ *** which is $100^{o}C$.

When measuring the temperature of something, try not to let the thermometer bulb touch the side or bottom of the container, as it may pick up more heat or cold than the contents of the container has. Also remember to read the mercury at eye level. To do this, you need to set the container on a table and bend down so that you are eye level with it.

Sometimes you are given a temperature in ^{o}F and you need to convert it to ^{o}C, or vice versa. You can do this by using one of the two formulas given below.

To go from ^{o}F to ^{o}C:

Subtract 32° then multiply by 5/9.

To go from ^{o}C to ^{o}F:

Multiply by 9/5 then add 32°.

Let's look at some examples of how to do this. If you want to change 32°F to °C, you would subtract 32 from 32°F. Then multiply that answer by 5/9. Your answer is 0°C.

$$32° - 32° = 0°$$

$$0 \times \frac{5}{9} = 0°C$$

If you want to change from 100°C to °F, you would multiply 100° by 9/5 and add 32°. Your answer will be 212°F.

$$\frac{9}{5} \times 100 = \frac{900}{5} = 180°$$

$$180° + 32° = 212°F$$

ACTIVITIES

Do all of the following activities.

22. Go to the Metric Center and get Worksheet #3-22. Complete this worksheet. When you finish, turn it in to your teacher.

23. Get Worksheet #3-23 from the Metric Center. Complete the worksheet and turn it in to your teacher.

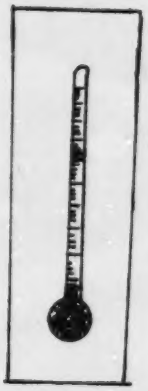
24. Get the small pan and the Celsius thermometer from the Measuring Station. Get Worksheet #3-24 from the Metric Center. Put a small amount of ice water in the pan. Place a Celsius thermometer in the ice water. Take a reading and record your answer on the chart on Worksheet #3-24. Take a reading every five minutes and record the temperature. Do this for a total of four times. Then take it every ten minutes until the end of the hour. Record the temperatures on the graph and connect the dots with lines. Write a short conclusion of what you found on the back of the chart. Turn the paper in to your tecaher to be checked.

When you feel that you understand this section, go to the Metric Center and get the Self Check--Section Two. When you have completed the self check, ask your teacher for the key. Check your paper, then turn in your paper and the key to your teacher.

0° C = Br-r-r, it's cold.

20° C = Ah-h-h, just right.

100° C = Whew, it's hot.



SECTION THREE

SUMMARY

LENGTH

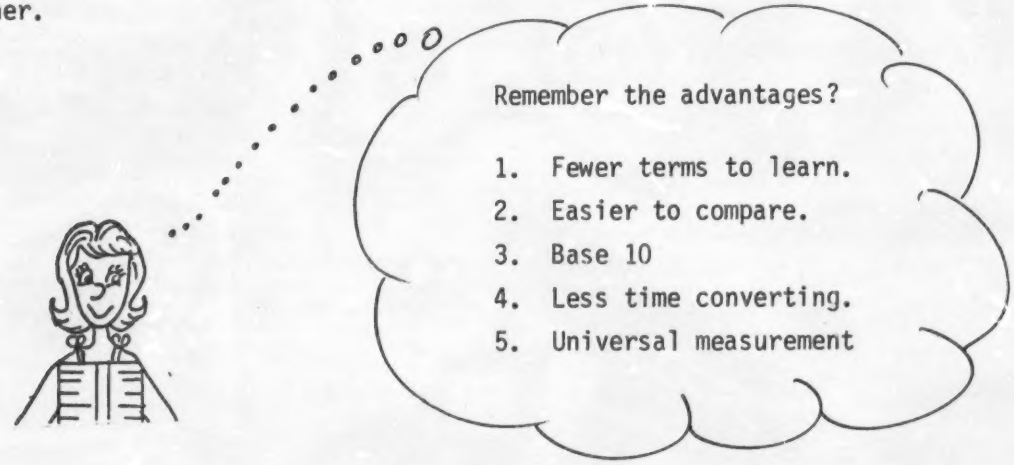
MASS

AREA

VOLUME

TEMPERATURE

In the capsules Basic Metrics: Parts 1, 2 and 3 we have covered a lot of information. You should have become more familiar and at ease using the metric system. Let's summarize the three parts and tie them all together.



Measuring length is done in millimeters, centimeters, meters, decameters, hectometers, or kilometers. Remember that these prefixes are used with each of the basic units: milli, centi, deci, deca, hecto, and kilo. The basic units can be meters, liters or grams.

Area is measured by multiplying the length by the width of the item being measured. The answer will be written in terms of $\underline{\text{unit}^2}$. For example: mm^2, cm^2, m^2, etc. If you needed to buy paneling for your room, you would have to know the area of each wall so that you could purchase the correct amount.

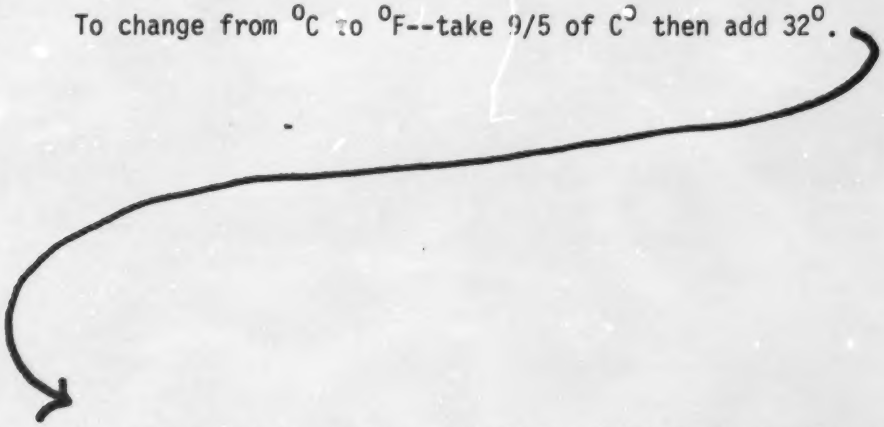
Volume/capacity is the amount that a container holds. It is found by multiplying the length by the width and the depth. Volume is usually measured in fractional parts of a meter, but can also be measured in liters or parts of liters. Volume is written in cubic units.

Mass is the weight an object has. It is measured in grams. It can be measured in kilograms, hectograms, decagrams, decigrams, centigrams or milligrams. To measure the weight, you need a set of scales and weights.

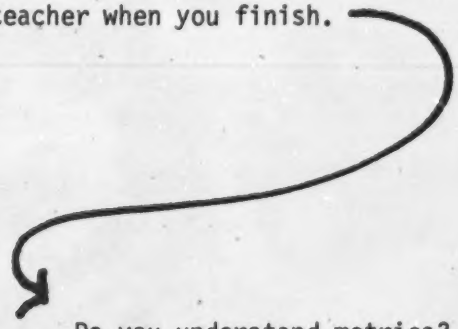
Temperature is also measured differently in the metric system. Instead of degrees Farenheit, you will use degrees Centigrade. You use a Celsius thermometer to measure temperature. You can also change from ^{O}C to ^{O}F or vice versa by using one of these formulas.

To change from ^{O}F to ^{O}C--subtract 32^{O} from ^{O}F then take 5/9 of answer.

To change from ^{O}C to ^{O}F--take 9/5 of C^{O} then add 32^{O}.



Go to the Metric Center and get the Self Check for Capsule 3. Complete the crossword puzzle. When you have finished, get the key from your teacher and check your paper. Turn your puzzle and the key in to your teacher when you finish.



Do you understand metrics? If you think so, get the post-test for Basic Metrics: Part 3 from your teacher. When you finish your post-test, return it to your teacher to be checked.

Following the post-test are some Quest activities if you would like to explore more metrics.

QUEST

1. Here is a brain teaser for you.
   a. Select a ^{o}C temperature.
   b. Double it.
   c. Add 40^{o}.
   d. Divide by 2.
   e. Subract 3 more than the original temperature.
   f. Double the result.
   g. Add 3.
   h. What temperature did you get?

2. Write a puppet show on the metric concepts that you have studied. Make the puppets and present the show to a group of elementary students.

3. Make a balance. You can use these directions or some of your own. You will need six pieces of string 30 cm long. Make three holes evenly spaced around the edge of an aluminum pie tin. Make a knot in one end of each string, and thread a string through each hole. Tie the loose ends of the three plate strings together on the end of a clothes hanger. Tie the other three ends to the other end of the hanger. Balance the coat hanger on a pencil or nail and you are ready to try out your balance.

4. View a film/filmstrip on metrics if one is available. Write a summary of the film/filmstrip and turn it in to your teacher.